Kia University

2003 SORENTO

Technical Highlights

and New Model Introduction

2003 Sorento Technical Highlights • Contents

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This Technical Highlights publication provides information about the new features, systems, and components used on the 2003 Sorento. We have included the most accurate and up-to-date information available at the time of publication. Due to constant improvement in our products, the information and specifications presented in this manual are subject to change without notice.

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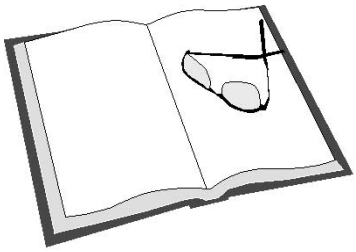
How to Use This Manual

This Sorento Technical Highlights publication serves two important purposes. Used with the 2002 Sorento Technical Highlights video, it's your key to a comprehensive understanding of all the new features, systems, and components that are included on the all new Sorento. Secondly, this manual is your initial model introduction training for the 2003 Sorento. Information about service procedures that are specific to the new systems is also included.

First, view the 2003 Sorento Technical Highlights video. Then, carefully read through this publication in its entirety.

Watch the video

Read, study, and review



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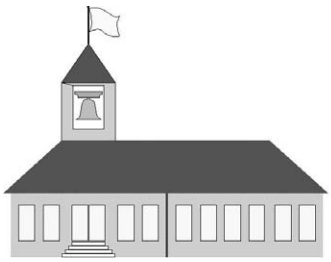

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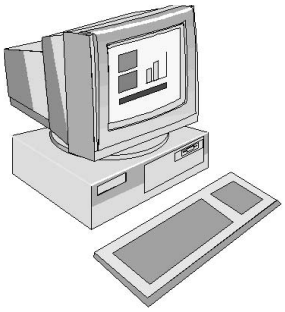


Section 1 • General Information

General Information

There are two Trim Levels for the 2003 Sorento: LX and EX. Both trim levels feature the Sigma 3.5 V6 engine and the 30-40LEI 4-speed automatic transmission.

Vehicle Specifications

The general specifications given here are for general information only, and are subject to change. Please check the Sorento Service Manual for the latest information.

Dimensions

Item	Inches
Overall length	179.8
Overall width	73.3
Overall height without roof rack	68.1
Overall height with roof rack	71.3
Wheelbase	106.7
Ground clearance	8.2
Approach angle	28.4
Departure angle	26.7

Weights (Gasoline Engine with Automatic Transmission)

Item	Pounds
GVWR	4x4—5,644 4x2—5,423
Curb weight	4x4—4,255 4x2—4,057
Weight distribution	4x4—54%/46% 4x2—56%/44%

Engine

Item	Gasoline Engine
Bore X Stroke	3.66 x 3.38 inches
Displacement	213.4 cubic inches (3497cc)
Compression ratio	10.0:1

Electrical System

Battery	CCA	600
	Capacity	12V/70AH
Alternator	13.5V/120A	
Starter	12V-1.2kw	
Spark Plug	Gap	1.0-1.1 mm (PFRSN-11)
	Type	Platinum NGK (RC1OPYPB4) Copper Champion

Capacities

Lubricant	Volume (SAW/Metric)	Classification
Engine Oil	5.8 quarts/5.5 liters	API Service SD or above
Transmission Oil	9 quarts/8.5 liters	Dextron III
Coolant	3 gallons/11.4 liters	
Brake Fluid	1.4 quarts/1.3 liters	SAE J1703, FMVSS 116 DOT 3 or DOT 4
Fuel	21.1 gallons/80 liters	87 Octane (as recommended in Owner's Manual)
Differential Fluid (w/o LSD)		GL-5, SAE 90
Differential Fluid (w/ LSD)		GL-5, SAE 85-90

Air Conditioner

Refrigerant complies with SAE J639	Refrigerant R-134a
Maximum operating charge	33 ounces

Tires

Tire Size	Wheel Size	Maximum Pressure
245/70 R16	6JJX15	35 PSI

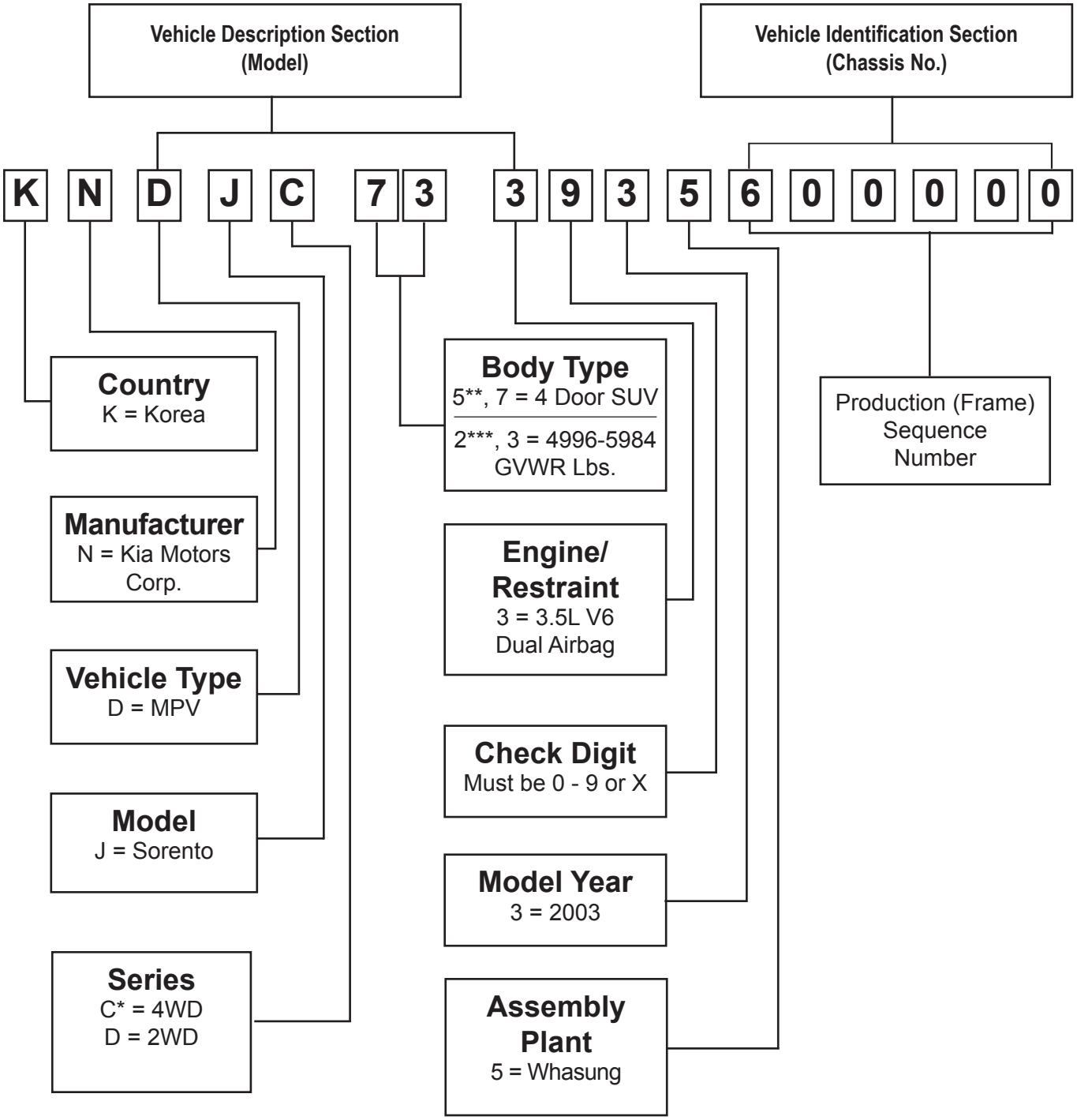
Light Bulbs

Light Bulb	Wattage
Headlamps (High/Low)	55/55
Front turn signal/position lights	28/8
Front fog lights (if equipped)	27
Rear turn signal lights	27
Stop and tail lights	27/8
Back-up lights	27
License plate lights	5
Interior Lights	10
Dome light	10
Rear cargo area light (if equipped)	10
High-mounted stop light (if equipped)	21
Door courtesy lights	5

Fuses

Refer to "Fuses" in the Owner's Manual Index.

Vehicle Identification Number Position



* For all vehicles manufactured between 4/27/2002 and 8/14/2002, the letter C indicates either 2WD or 4WD.

** For all vehicles manufactured between 2/28/2002 and 8/14/2002, the number 5 indicates a 4-door SUV.

*** For all vehicles manufactured between 2/28/2002 and 8/14/2002, the number 2 indicates a GWVR of 2,271 - 2,720 kg (4,996 - 5,984 lbs.)

Features and Options

		LX	EX
3.5 DOHC 6-cylinder (192 HP)		S	S
4-Speed automatic		S	S
Power Steering	Engine speed sensing	S	—
	Vehicle speed sensing	—	S
Steering linkage	Rack & pinion	S	S
Hood blanket		S	S
Suspension	Front: Wish-bone w/coil spring	S	S
	Rear: 5-Link coil spring	S	S
Gas shocks		S	S
Fuel tank	80 liters / 21.1 gallons	S	S
2-Speed transfer case		4WD	4WD
4WD	Push button part-time type	4WD	4WD
	Torque on demand full-time (w/low range)	—	Lux
Free running differential (more advance system than automatic locking hubs)		4WD	4WD
Limited slip rear differential (not an option)		4WD	4WD
Tow package (Trailer hitch and wiring harness connector)		PIO	PIO
Self-levelizer		—	O

Features and Options

		LX	EX
Wheels	Styled steel	S	—
	Alloy (bright machine finish face)	O	S
Tires	P245/70R16 (domestic bound)	S	—
	P245/70R16 (Michelin)	—	S
Full size spare tire under vehicle (alloy steel if equipped with alloys)		S	S
Mudguards		ACC	ACC
Windshield	Solar control glass	S	S
Side glass (B-pillar back)	Privacy glass	S	S
Power sunroof (tilt and slide)		—	S
Grille	Black mesh insert w/chrome surround	S	S
Door handles	Body color	S	S
	Body color/chrome accent	—	Lux
Mirrors	Dual power, heated (black)	S	—
	Dual power, heated (body color)	—	S
Fog lamps		—	S
Head lamps	Multi-reflector head lamps	S	S
	Auto lamps	—	Lux
Roof rack	Black	O	S
Bumpers	Body color	S	—
	Two-tone	—	S
Bodyside cladding, fender flares	Two-tone	—	S
Rear garnish	Body color	S	S
	Chrome	—	Lux
Rear spoiler		O	O
Manual fuel door & gas cap with tether		S	S
Rear split hatch liftgate	w/flip-open glass operated with remote or inside release	S	S
Towing hooks	Front and rear	S	S
Skid plates (front-end, fuel tank)		S	S

Features and Options

		LX	EX
Seat upholstery & trim inserts	Double raschel cloth seat and door trim	S	—
	Moquette velour cloth seat and door trim	—	S
	Leather	—	O/Lux
Front seats	8-Way manual adjustment (driver)	S	—
	8-Way power adjustment (driver)	—	S
	Heated (driver & passenger)	—	Lux
	Lumbar adjustment (driver)	S	S
	W/Tilt adjustable headrests	—	S
Rear seat	60/40 split flat folding rear seats	S	S
	Fold down armrest	S	S
	Removable headrest (all three positions)	S	S
Steering wheel	Leather wrapped	—	S
	Leather wrapped/wood grain	—	Lux
Shifter	Black PRNDL, shift shaft, knob	S	—
	Brushed metal style PRNDL, chrome shaft, black knob	—	S
	Brushed metal PRNDL, chrome shaft, wood grain accent knob	—	Lux
Inside door handles	Color keyed	S	—
	Chrome	—	S
Scuff plates	Color keyed	S	—
	Bright stainless steel	—	S
Wood grain center fascia/console accents		—	S
Fabric headliner		S	S
Cut pile carpet		S	S

Features and Options

		LX	EX
Dome lights with fade-out feature (illuminated entry and exit) and I/P dimmer switch master control		S	S
In-door safety/courtesy lights		S	S
Large felt-lined coinholder bin		S	S
Under seat storage bin		S	S
Rear quarter panel storage bins		S	S
Digital clock (in dash)		S	S
Tachometer		S	S
Horn	Dual	S	S
Electrochromatic rear view mirror with homelink programmable garage door opener (no Lux installation)		—	S
Remote keyless entry	W/Door lock, panic, rear glass open (no Lux installation)	—	S
Power windows with one-touch drivers express down feature		S	S
Power door locks (two-turn entry system)		S	S
Assist grips	Four positions	S	S
Garment hooks	Roof-mounted, rear LH & RH	S	—
	Assist grip mounted, rear LH & RH	—	S
Tilt steering wheel		S	S
Rear cargo cover		S	S
Cargo net		ACC	S
Cargo net hooks		S	S
Under rear cargo floor storage compartments		S	S
Rear cargo lamp w/ on/off switch		S	S
Driver and passenger sunvisors (slide-out); dual covered & illuminated vanity mirrors		S	S
Air conditioning	Manual	S	S
	Automatic	—	Lux
(2) Front, (1) Second row, (1) Cargo area 12-volt power points		S	S
Cruise control with steering wheel controls		S	S
(4) Floor mounted cargo tie-down hooks (also used for cargo net on EX		S	S
Driver's foot rest		S	S
Overhead Console	Sunglass storage, map lights, garage door opener pocket	S	S
	Multi-meter (outside temp., compass, altimeter, barometer— not on FATC vehicles	—	S
Center console with armrest, dual storage (top small items, bottom CD/Cassettes)		S	S
Dual rear cupholders (rear console)		S	S
Dual center console cupholders		S	S
Straight into dash (not in steering column) illuminated ignition switch		S	S
Lockage, large glove box with upper map pocket		S	S
LCD odometer with two trip meters		S	S

Features and Options

		LX	EX
Audio Systems			
AM-FM/CD 8 speakers/6 enclosures		S	—
Delphi premium AM/FM/Cassette/CD audio with separate amplifier, 10 speakers/6 enclosures		—	S
Delphi premium AM/FM 6 disk in-dash CD with separate amplifier, 10 speakers/6 enclosures		—	Lux
Steering wheel audio controls		—	S
Antenna	One pole	S	S
Safety			
Battery saver		S	S
Brake	Front and rear disc	S	S
Dual airbags	Steering wheel, instrument panel air bags (no seam)	S	S
Side curtain airbags		S	S
Rear child safety door locks		S	S
High mounted stop lamp		S	S
Fixed upper & lower anchors for child safety seats (LATCH system)		S	S
First aid kit in rear quarter panel storage bin (KMA)		S	S
Two-speed variable intermittent wipers		S	S
Rear window defogger		S	S
Rear window wiper/washer (intermittent)		S	S
Front windshield de-icer (hot wire)		S	S
Low fuel warning indicator		S	S
Washer fluid low warning indicator		S	S
4-Wheel ABS		O	O
Side impact protection		S	S
Seat belts	3-Point emergency locking retractor (all seating positions)	S	S
	Adjustable anchors in front	S	S
	Pretensioner & force limiter (front seats)	S	S
Energy absorbing steering column		S	S
Fuel cut-off system		S	S

S: Standard
O: Optional
—: Not available
ACC: Accessory
Lux: Luxury package
TP: Tow Package

Options

Options

- ABS (all)
- Self-Levelizer (EX)
- Floor mats (LX)
- Cargo tray (all—PIO)
- 4-wheel drive (all)
- Rear spoiler (EX)
- Alloy wheels (LX)
- Roof rack (LX)
- Leather package (EX)
- AM/FM/6 in-dash disc CD (EX)
- Tow package

EX Model Includes

- Two-tone exterior
- Sunroof
- Roof rack
- Fog lamps
- Body color outer mirror (dual power, heated)
- Bright machine finished aluminum wheels
- Moquette velour seat trim
- Wood grain center fascia/console accents
- Power driver's seat
- Leather-wrapped steering wheel
- Chrome-plated inner door handles
- Chrome shifter shaft
- Brushed metal style PRNDL base plate
- Overhead console adds Multi-meter (outside temp., compass, altimeter, barometer)
- Rear cargo cover, cargo net
- Electro-chromatic rearview mirror
- Homelink in rear view mirror
- Keyless entry system (two remotes)
- Delphi premium AM/FM stereo radio, cassette, CD player with separate amplifier, 10 speakers, steering wheel audio controls
- Bright stainless steel scuff plates

Luxury Package (available on EX grade only)

- Optional 4WD-torque on demand type
- Chrome outside door handles
- Chrome rear garnish
- Auto climate control
- Heated front seats
- Leather package
- Wood grain/leather steering wheel
- Wood grain accent shift knob
- Auto headlamps
- Delphi premium AM/FM/6 in-dash disc CD with separate amplifier, 10 speakers, steering wheel audio controls

Tow Package (TP—all)

- Trailer hitch receiver, ball mount, ball (PIO)
- Wiring harness with 4-wire connector (PIO)

Exterior and Interior Colors

Sorento Exterior Color Matrix - KMA -

Code	Exterior Color	Interior Color (LX/EX)	
		Beige (44)	Gray (BT)
UD	Clear White	X	X
D3	Silky Beige	X	—
C9	Silver Metallic	—	X
P7	Misty Blue	X	X
P1	Blue Sapphire	X	X
R9	Ruby Red	X	X
G6	Dark Emerald Green	X	X
9B	Midnight Black	X	—
WM*	UD/D3	X	—
IN*	P7/C7	—	X
WL*	P1/C7	—	X
ZG*	G6/D3	X	—
HM*	R9/D3	X	—
WN*	9B/C7	—	X
AH*	G6/C7	—	X
WU*	UD/C7	—	X
WR*	R9/C7	—	X
WP*	P1/D3	X	—

* Option on EX only

Normal Maintenance Schedule

Schedule 1—Normal Maintenance

Maintenance Intervals / Maintenance Item	Number of Months or Kilometers (Miles), whichever comes first															
Months	7.5	15	22.5	30	37.5	45	52.5	60	67.5	75	82.5	90	97.5	105	112.5	120
Miles x 1000	7.5	15	22.5	30	37.5	45	52.5	60	67.5	75	82.5	90	97.5	105	112.5	120
(km x 1000)	(12)	(24)	(36)	(48)	(60)	(72)	(84)	(96)	(108)	(120)	(132)	(144)	(156)	(168)	(180)	(200)
Drive Belts				I				I				I				I
Engine Oil	Replace every 7,500 miles or 12 months															
Engine Oil Filter	Replace every 7,500 miles or 12 months															
Automatic Transmission Fluid	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
Engine Timing Belt				I				R(1)				I				R
Air Cleaner Element				R				R				R				R
Spark Plugs								R								R

Notes:
I - Inspect
R - Replace
(1) - For California. This maintenance is recommended, but not required.

Normal Maintenance Schedule

Schedule 1—Normal Maintenance (continued)

Maintenance Intervals / Maintenance Item	Number of Months or Kilometers (Miles), whichever comes first																
Months	7.5	15	22.5	30	37.5	45	52.5	60	67.5	75	82.5	90	97.5	105	112.5	120
Miles x 1000	7.5	15	22.5	30	37.5	45	52.5	60	67.5	75	82.5	90	97.5	105	112.5	120
(km x 1000)	(12)	(24)	(36)	(48)	(60)	(72)	(84)	(96)	(108)	(120)	(132)	(144)	(156)	(168)	(180)	(200)
Cooling System				I				I				I				I
Engine Coolant				R				R				R				R
Idle Speed				I (2)				I (2)				I (2)				I (2)
Fuel Filter				I (1)				I (1)				I (1)				I (1)
Fuel lines and hoses				I (2)				I (2)				I (2)				I (2)
Hose and tube for emission				I (2)				I (2)				I (2)				I (2)
Transfer Case Oil (if equipped)	I	I	R	I	I	R	I	I	R	I	I	R	I	I	R	I
Manual Transmission Fluid	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
Automatic Transmission Fluid		I		I		I		I		I		I		I		I
Front Differential Fluid (if equipped)	I	I	R	I	I	R	I	I	R	I	I	R	I	I	R	I
Rear Differential Fluid	I	I	R	I	I	R	I	I	R	I	I	R	I	I	R	I
Ignition Wires								I								

Notes:
I - Inspect, and if necessary, adjust
R - Replace
(1) - This maintenance is required in all states except California, However, we recommend that it also be performed on California vehicles.
(2) - This maintenance is recommended by Kia. However, it is not necessary for emission warranty coverage or manufacturer recall liability.

Schedule 1—Normal Maintenance (continued)

Maintenance Intervals / Maintenance Item	Number of Months or Kilometers (Miles), whichever comes first																
Months	7.5	15	22.5	30	37.5	45	52.5	60	67.5	75	82.5	90	97.5	105	112.5	120
Miles x 1000	7.5	15	22.5	30	37.5	45	52.5	60	67.5	75	82.5	90	97.5	105	112.5	120
(km x 1000)	(12)	(24)	(36)	(48)	(60)	(72)	(84)	(96)	(108)	(120)	(132)	(144)	(156)	(168)	(180)	(200)
Brake Lines and Connections		I		I		I		I		I		I		I		I
Parking Brake				I				I				I				I
Disc Brakes		I		I		I		I		I		I		I		I
Brake Fluid/Clutch Fluid (if equipped)		I		I		I		I		I		I		I		I
Steering Operation and Linkage				I				I				I				I
Front Suspension Ball Joints				I				I				I				I
Driveshaft Dust Boots				I				I				I				I
Chassis/Body Nuts and Bolts				I				I				I				I
Front & Rear Driveshaft U-joints		L		L		L		L		L		L		L		L
Exhaust System Heat Shield				I				I				I				I
All Locks and Hinges	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
A/C Refrigerant (if equipped)	Inspect refrigerant amount annually															
A/C Compressor (if equipped)	Inspect operation annually															

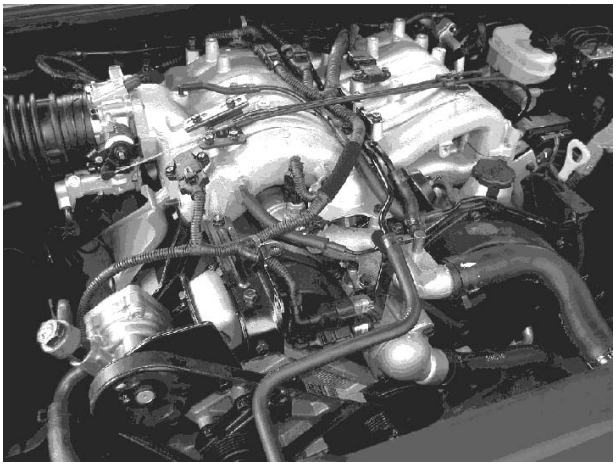
Sigma 3.5 Engine

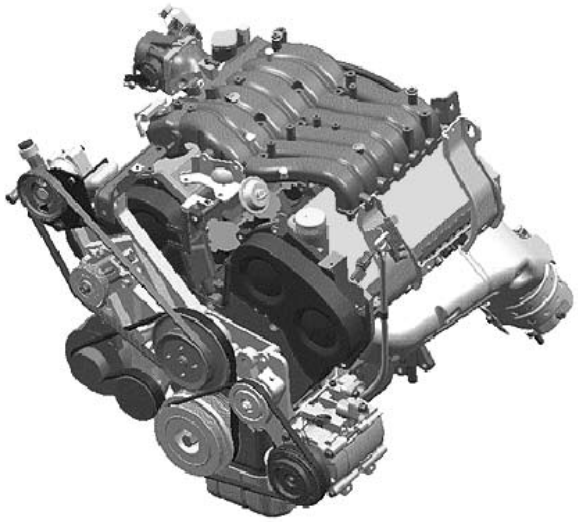
The Sorento is equipped with a **Sigma 3.5 Liter engine**, which is the same as the Sedona but with a different Variable Intake System.

The **intake manifold** utilizes a variable intake system, which extends the torque curve, by selecting designated intake runners to improve performance. The **block** is made of cast iron. The **cylinder heads** and **upper oil pan** are aluminum. **Hydraulic Lash Adjusters (HLA)** eliminate the need for valve adjustments.

There are three **drive belts** with mechanical tensioners. The **timing belt** turns all four cam sprockets with a hydraulic timing belt tensioner.

The engine is mounted at 4º inclination, higher in front, in order to accommodate the front differential. A fitting is provided on the thermostat housing linking the front water jackets of both heads through a pipe to the surge tank. ***This design assures automatic air bleeding of the system.***





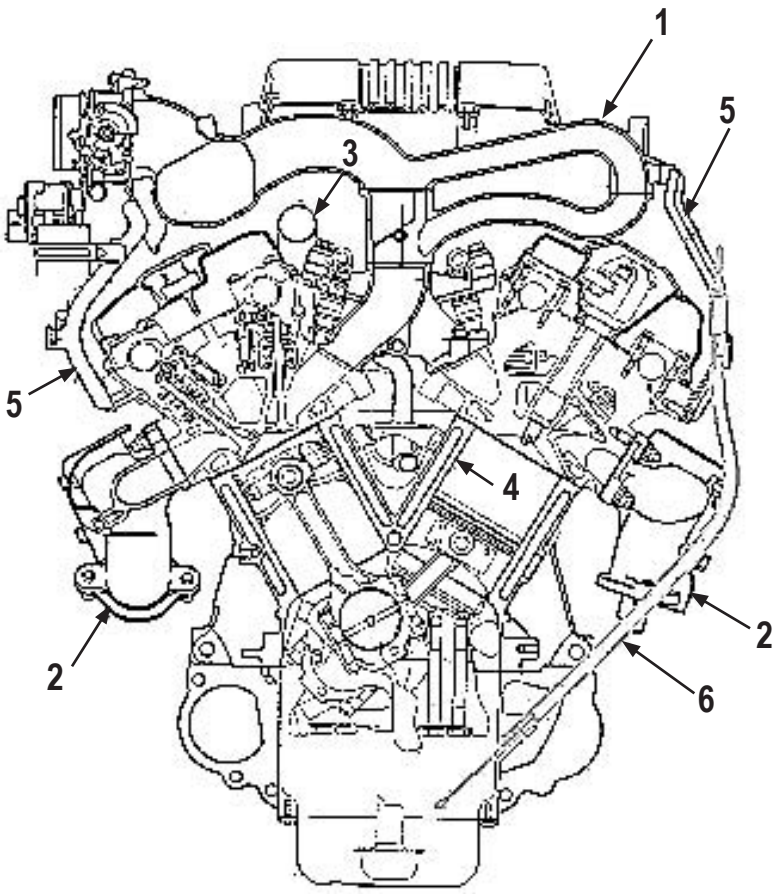
Features

- DOHC
- 10:1 compression ratio
- Idle speed: 800 RPM±100

General Description

Items	Sigma 3.5 L
Displacement	3,497 cc
Bore x stroke	93 x 85.5 mm
Compression ratio	10:1
Firing order	1-2-3-4-5-6
Basic ignition timing	10º BTDC
Idle RPM	800 ± 100
HLS	End Pivot Type
Fuel Pressure (regulated)	47-48 psi
Injector type	4 hole
Injector timing	17 BTDC
Spark plug	PFRSN-11
Spark plug gap	1.0 – 1.1 mm
Oxygen sensor	ZrO2
Coolant control	Inlet Control
Air flow sensor	Hot Film
EMS	MELCO

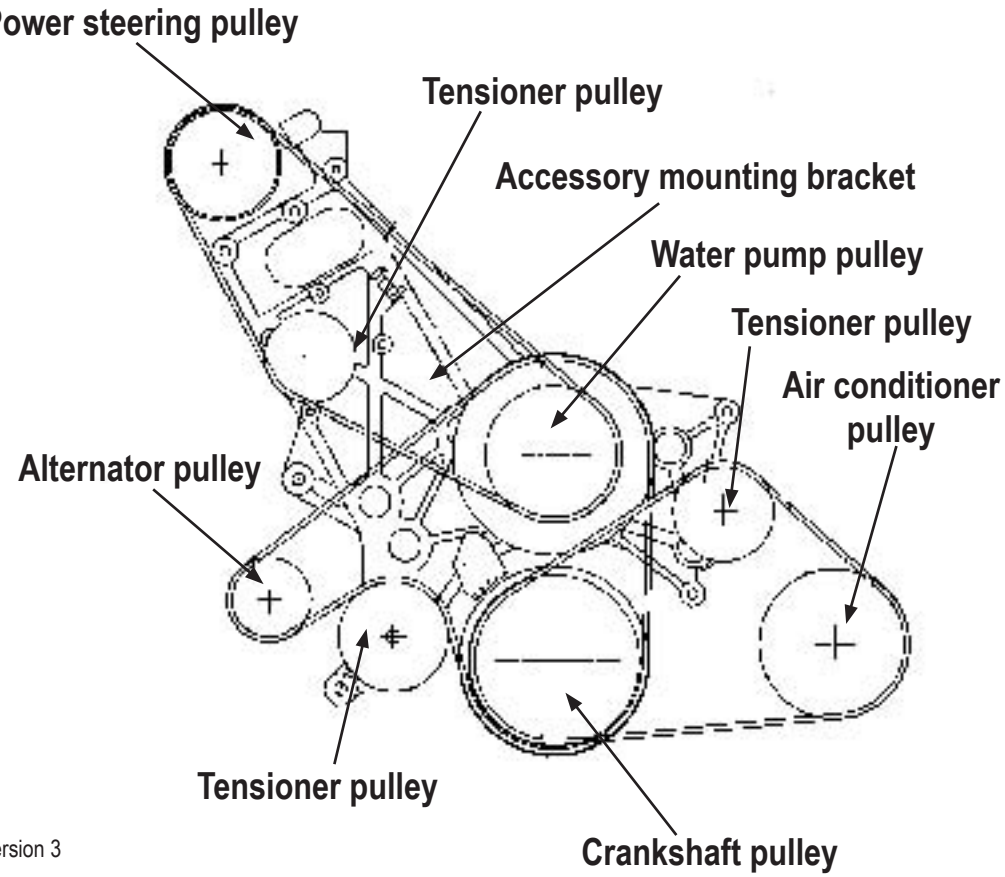
- End Pivot Type Hydraulic Lash Adjusters
- Aluminum heads
- Cast iron cylinder block
- Aluminum upper oil pan



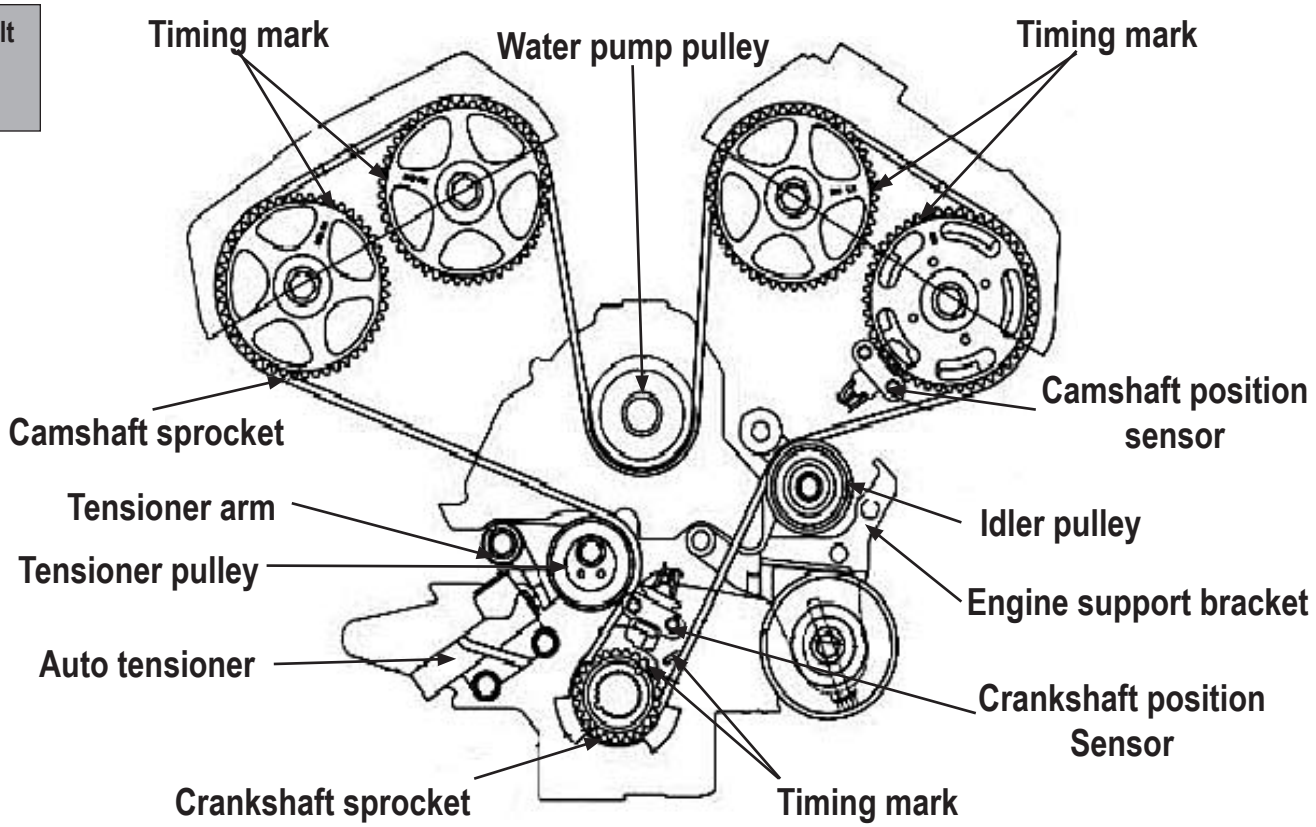
1 Variable Intake System
2 Exhaust Manifold
3 Thermostat Housing
4 Engine Block
5 Bracket
6 Dipstick Tube

Drive Belts

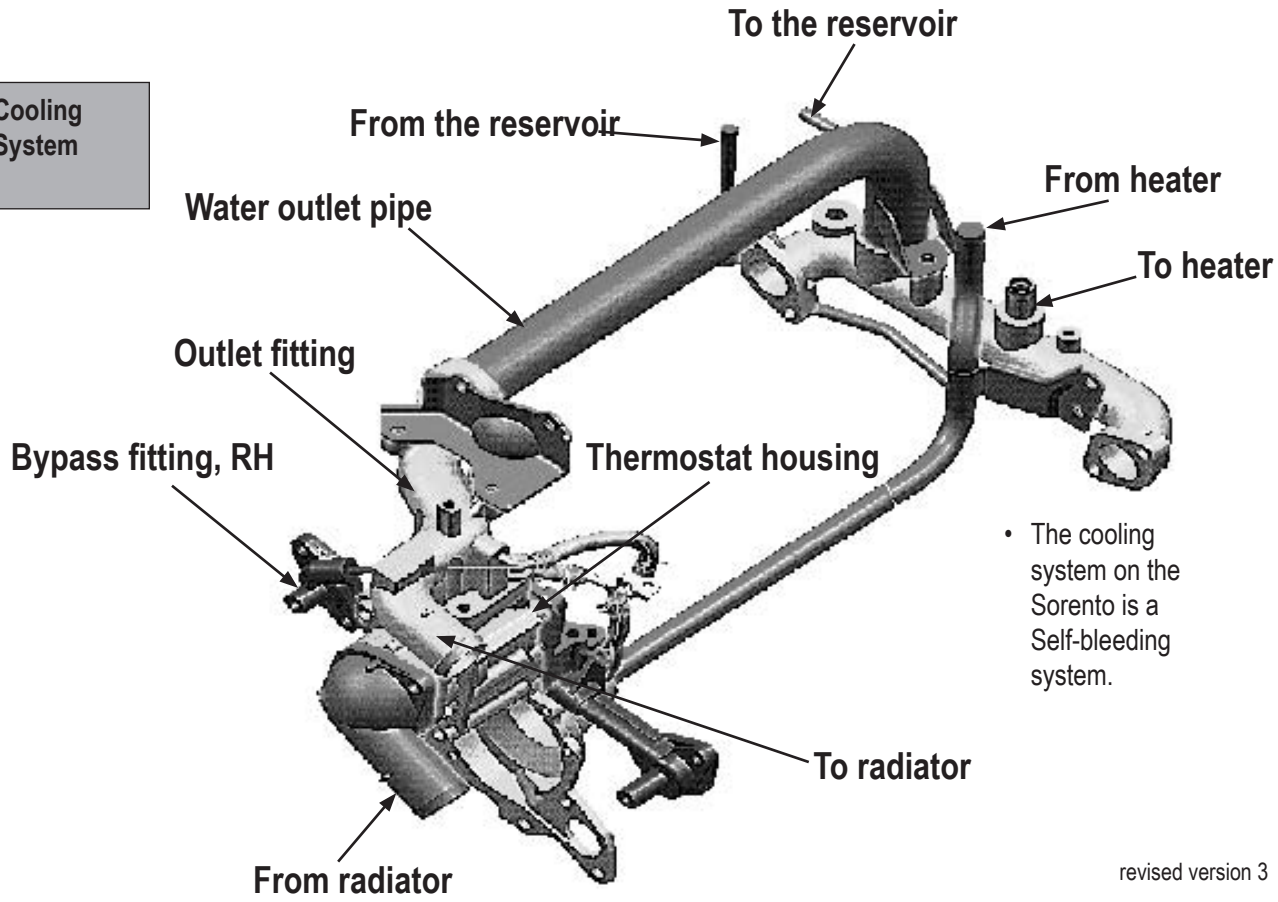
- Three drive belts
- Three tensioners



Timing Belt



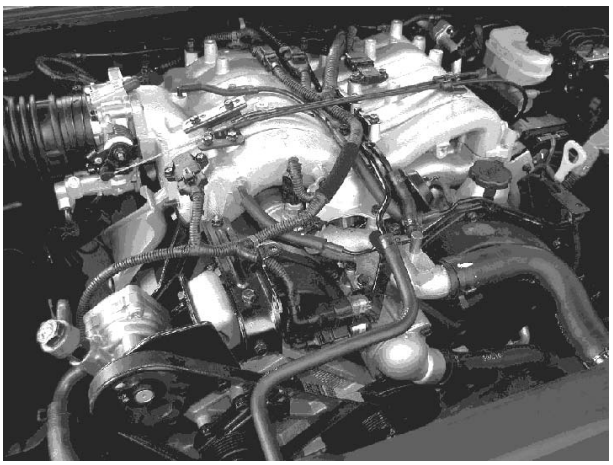
Cooling System



- The cooling system on the Sorento is a Self-bleeding system.

Ignition System

The Sigma 3.5 V6 engine uses a **distributorless ignition system** with the ECM controlling and monitoring ignition system functions. Three ignition coils are located above cylinders 2, 4, and 6 (cylinder bank 2); three spark plug wires connect the coil assemblies to cylinders 1, 3, and 5. The coils feature integrated power transistors. The coils are also physically smaller than those in the Sedona 3.5L. The ignition system in the 2003 Sorento is a **wasted-spark system**. For fault detection purposes, an **Ignition Failure Sensor** is employed.



Ignition Failure Sensor

The **Ignition Failure Sensor (IFS)** monitors the coil primary waveform. When the primary circuit is turned OFF by the ECM, the collapse of the magnetic field induces a high voltage in the secondary winding. An inductive spike is then in turn induced in the primary winding of the coil. This inductive spike is detected by the IFS, which then generates a digital **Ignition Detect Signal**. The output from the IFS is routed to the ECM and the vehicle tachometer.

By monitoring the digital output of the IFS, the ECM can detect the presence of an ignition system malfunction. A P0350 DTC is generated and stored upon detection. (Two drive cycles are required for MIL illumination.) The ignition system monitoring functions are conducted under 4000 RPM. IFS failures can cause a P0320 DTC; this DTC is a one-trip code.

Charging System

The **charging system** on the 2003 Sorento utilizes a generator with a built-in voltage regulator. The ECM does not control the field circuit operation (as on Sedona).

Generator

- 13.5v/120 amps

Starter

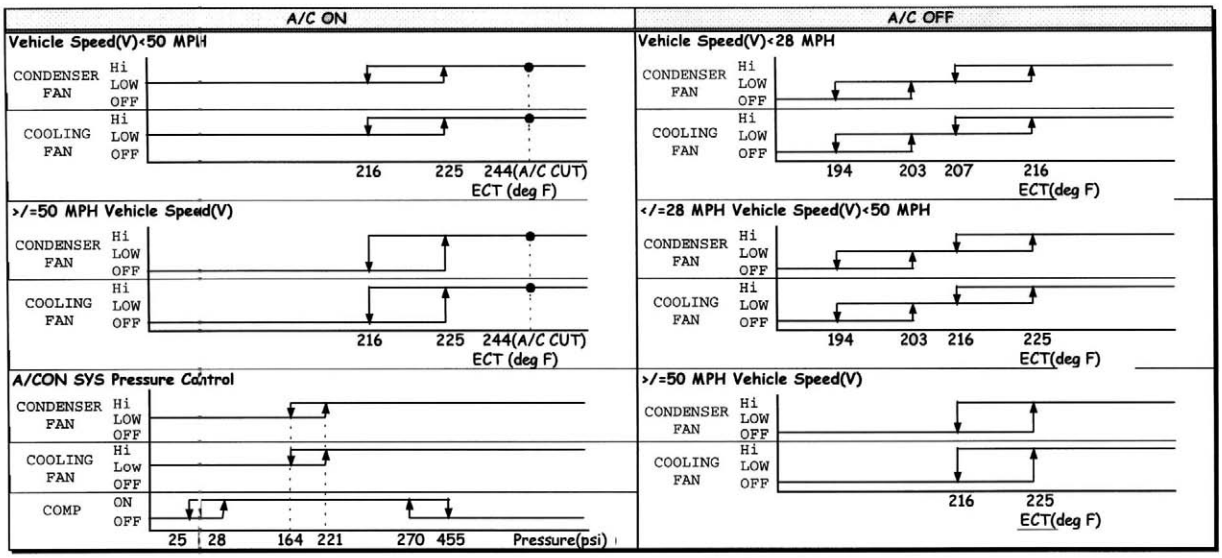
A reduction drive type starter is used. The starter motor current draw should be 90 amps or less.

Battery

The 2003 Sorento uses a single 12V 600CCA battery.

Cooling/ Condenser Fan Control

Engine cooling and condenser fans are ECM-controlled through a series of three fan relays located in the engine compartment fuse and relay box. Both fans feature high and low speeds which are actuated based on the ECT, vehicle speed, the A/C switch position, and the A/C system triple pressure switch position.

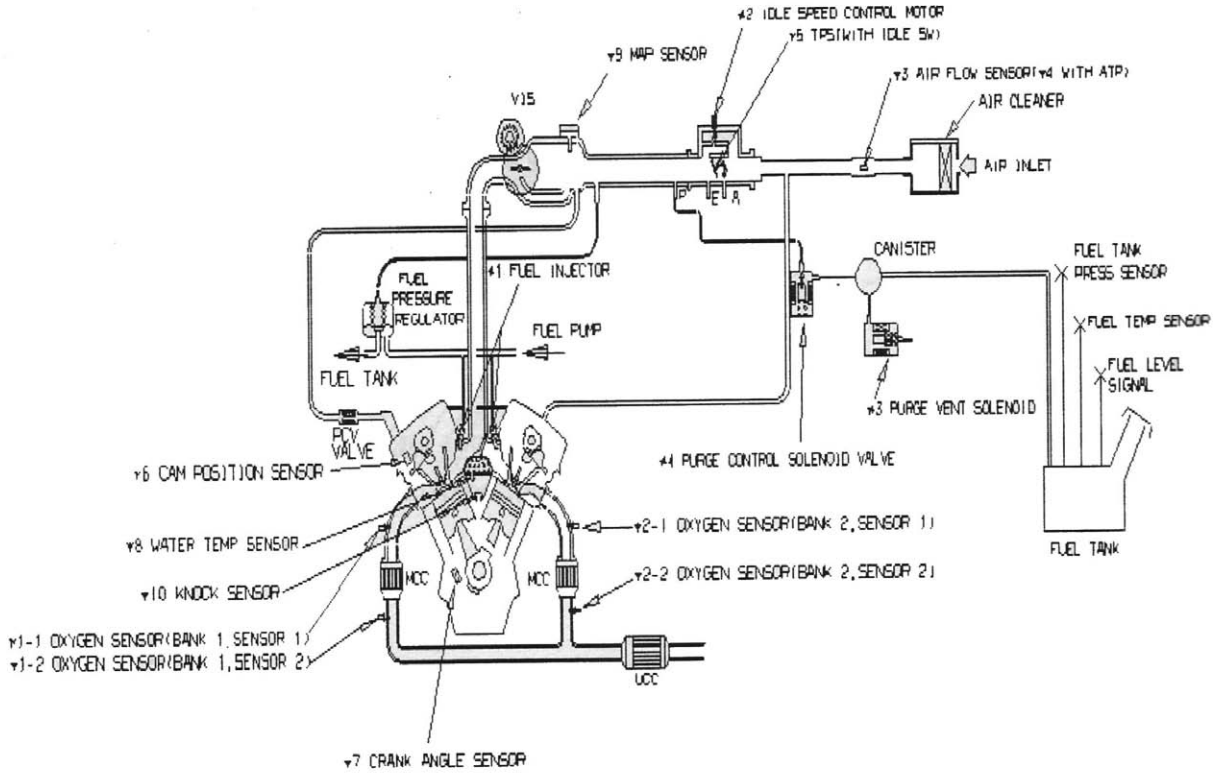


Section 4 • Fuel and Emissions–General

General Information

The 2003 Sorento is fitted with a **Mitsubishi Electronics Company Engine Management System (MELCO)**, utilizing a 32-bit ECM with a separate TCM. The ECM and TCM communicate via a **Controller Area Network (CAN)**. **Sequential Multiport Fuel Injection** is incorporated and a distributorless ignition system is used.

The 2003 Sorento is certified as a Low Emissions Vehicle (LEV). The Evaporative Emissions Systems employs an On-Board Refueling Vapor Recovery (ORVR) valve along with a rollover valve and supports .5mm leak detection via a vacuum leak check method. Three 3-way catalytic converters (one at each exhaust manifold), one underneath the vehicle) have been fitted. The 2003 Sorento does not use Exhaust Gas Recirculation (EGR). Engine management system monitoring functions are conducted in compliance with OBD-II regulations.

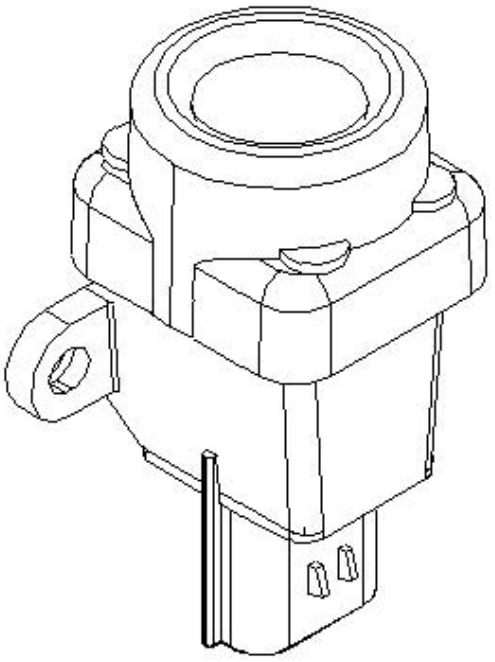


Fuel Delivery

Fuel delivery on the 2003 Sorento is ECM controlled. Fuel pressure from the in-tank pump is managed via a pressure regulator installed on the fuel rail (49-50 PSI unregulated pressure; 39 PSI regulated). A fuel return line after the regulator leads to the fuel tank. A fuel pump priming pulse is not employed. The fuel filter is located in the fuel tank and is installed on the delivery module assembly. Access to the fuel delivery module is facilitated by folding the bottom of the rear seat forward and removing the access plate on the passenger side. The fuel pump relay is located in the engine compartment fuse and relay box.

Fuel Cut Sensor

A **Fuel Cut Sensor** (inertia switch) is installed in the circuit, located on the passenger side inner fender near the air box, between the fuel pump relay and the fuel pump. The normally closed switch is physically located on the passenger side of the engine compartment. Within the switch, a steel ball on a cone shaped seat is held in place via the force created by a magnet fitted under the cone shaped seat. The steel ball will overcome this magnetic force when a shock (equivalent to a 9 MPH collision) is transmitted to the sensor through the body of the vehicle. Once the ball has overcome the magnetic force, it strikes a moveable contact; the switch is thereby opened, interrupting current flow to the fuel pump. A switch on top of the sensor is installed to facilitate resetting normal fuel pump operation. Continuity should be present between the two outer terminals once the reset switch has been pressed.

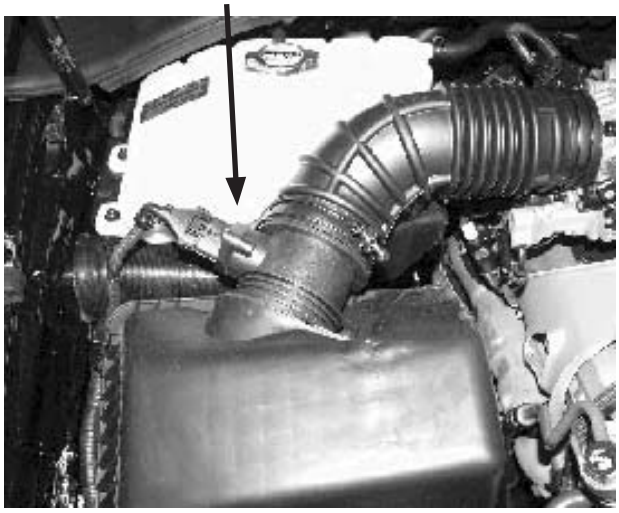


Input/Output

Input	ECM	Output
Oxygen Sensor (Bank 1, Sensor 1)	Manifold Differential Pressure Sensor	Ignition
Oxygen Sensor (Bank 1, Sensor 2)	Knock Sensor	Injector
Oxygen Sensor (Bank 2, Sensor 1)	Fuel Level Sensor	Idle Speed Cont. Motor
Oxygen Sensor (Bank 2, Sensor 2)	Fuel Tank Pressure Sensor	Main Relay Control
Mass Air Flow Sensor	Fuel Temperature Sensor	Fuel Pump Control
Air Temperature Sensor	Ignition Failure Sensor	Cooling Fan Control
Throttle Position Sensor	Vehicle Speed Sensor	Diagnosis (OBD)
Camshaft Position Sensor	Power Steering Sensor	VICS Vacuum Solenoid
Crankshaft Position Sensor	Ignition Switch	
Coolant Temperature Sensor	Battery Voltage	

Mass Air Flow Sensor (MAF)

The 2003 Sorento employs a Bosch hot film type Mass Air Flow sensor (MAF) which has an integrated Negative Temperature Coefficient (NTC) Intake Air Temperature Sensor (IAT). The MAF is located between the air cleaner and the throttle body on the passenger side of the engine compartment.



Note: *MAF failures resulting from physical damage to the sensing element will cause a fixed output value of about 1.0 VDC.*

MAF Output

- 1.4-1.6VDC at idle
- MAF values are displayed in Hi-Scan Current Data as voltage, airflow, and calculated load.

IAT Output

- 3.2-3.8V @ 32° F
- 2.3-2.9V @ 68° F
- 1.5-2.1V @ 104° F
- 0.5-0.9V @ 178° F
- IAT voltage and intake air temperature values are displayed in Hi-Scan Current Data.

Throttle Position Sensor (TPS)

The **Throttle Position Sensor (TPS)** consists of a potentiometer together with an idle switch, which is installed on the throttle body assembly. TPS information is shared with the TCM via the Controller Area Network (CAN). In addition, a **Pulse-Width Modulated (PWM)** version of the TPS signal is transmitted by the ECM to the torque-on-demand **transfer case control unit (TCCM)**.

TPS Values

- 0.3-0.9V @ idle
- 4.0-4.6V @ WOT
- The Idle Switch is monitored separately from the TPS signal and has its own DTC (P0510)
- TPS percentage, voltage, and idle switch status can be viewed in Hi-Scan Current Data

Engine Coolant Temperature Sensor (ECT)

The **Engine Coolant Temperature Sensor (ECT)** is installed in the water outlet fitting and supplies the ECM with coolant temperature information in addition to controlling the temperature gauge on the instrument cluster. The ECT is fitted with gold-plated terminals. The ECT is a negative temperature co-efficient thermistor.

ECT Output Values

- 3.2-3.8V @ 32° F
- 2.3-2.8V @ 68° F
- 1.5-2.1V @ 104° F
- 0.4-0.8V @ 178° F
- ECT (temperature) is viewable in Hi-Scan Current Data

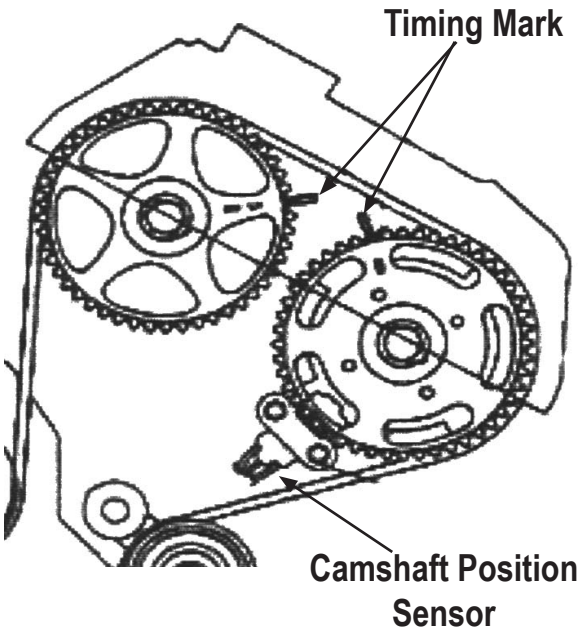
Heated Oxygen Sensors (HO2S)

Four Zirconia type **Heated Oxygen Sensors (HO2S)** are installed on the 2003 Sorento (two upstream, two downstream). The front HO2S provide exhaust gas oxygen content information to the ECM for air/fuel ratio control in the closed loop mode. For catalyst monitoring purposes, the rear heated oxygen sensor signals are compared to the front HO2S.

- Fuel trim values under typical normal operating conditions: +/- 12.5%
- HO2S voltage values and heater data can be seen for each sensor. In addition, Hi-Scan Current data provides Fuel Trim (long term/short term) information for each bank.

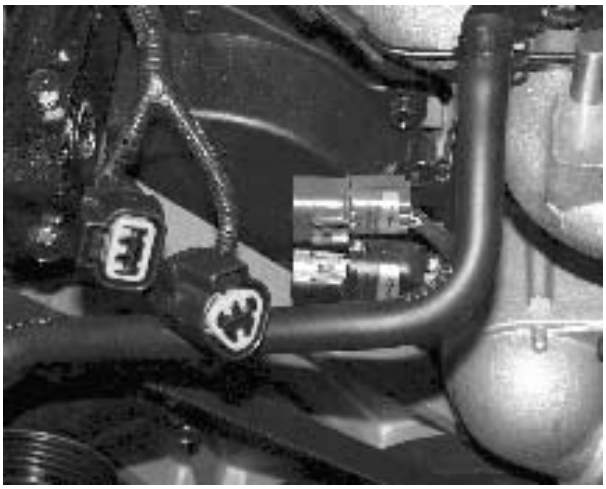
Camshaft Position Sensor (CMP)

A Hall-Effect **Camshaft Position Sensor (CMP)** is installed adjacent to the exhaust camshaft sprocket on cylinder bank 2 underneath the upper timing cover. The trigger wheel has four blades; the blade for the number 1 cylinder is longer than the other three. The ECM Signal utilizes output from the CMP (in conjunction with CKP output) to ensure proper injector sequencing.



Crankshaft Position Sensor (CKP)

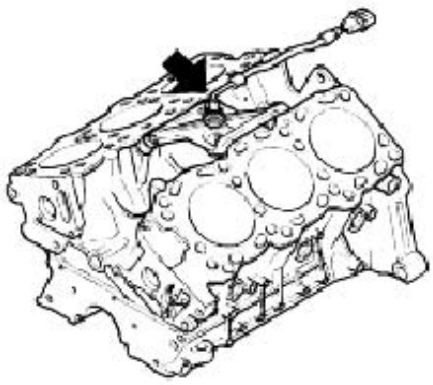
The **Crankshaft Position Sensor (CKP)** is of the Hall-Effect type. The CKP is mounted adjacent to the crankshaft sprocket underneath the lower timing cover. A three-blade trigger wheel is mounted behind the crankshaft sprocket. The ECM determines engine speed through the CKP output in addition to detecting misfires. The automatic transmission also requires engine speed information; CKP signals are shared with the TCM via the CAN.



The Hi-Scan Current Data display for CKP information is limited to RPM data only (connectors shown).

Knock Sensor (KS)

A single **Knock Sensor (KS)** is used on the 2003 Sorento and employs a shielded signal circuit. Knock sensor failures will not illuminate the MIL; a DTC (P0325) will be stored.



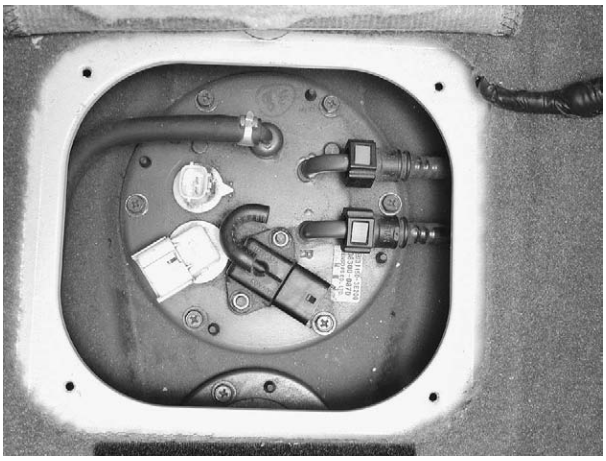
Fuel Tank Pressure Sensor (FTPS)

A **Fuel Tank Pressure Sensor (FTPS)** is located on the fuel delivery module. The ECM evaluates FTPS signal information for purge and close valve operation in addition to testing the EVAP system for the presence of a leak.

- The FTPS is monitored as a Comprehensive Component. However, EMS design requires that specific enable conditions be met before the FTPS output voltage is checked.
- Battery voltage must be >/= 10VDC.
- IAT at initial engine start must be above 41° F.
- Load value must be between 25-70%.
- Engine speed must be above 1438 RPM.
- Vehicle speed must be above 18.64 MPH.

FTPS output values

- 2.2-2.8VDC with key on, engine off and fuel cap loosened.
- FTPS data (expressed as mmHG or millimeters of mercury) can be seen in Hi-Scan Current Data.



Fuel Tank Pressure Sensor

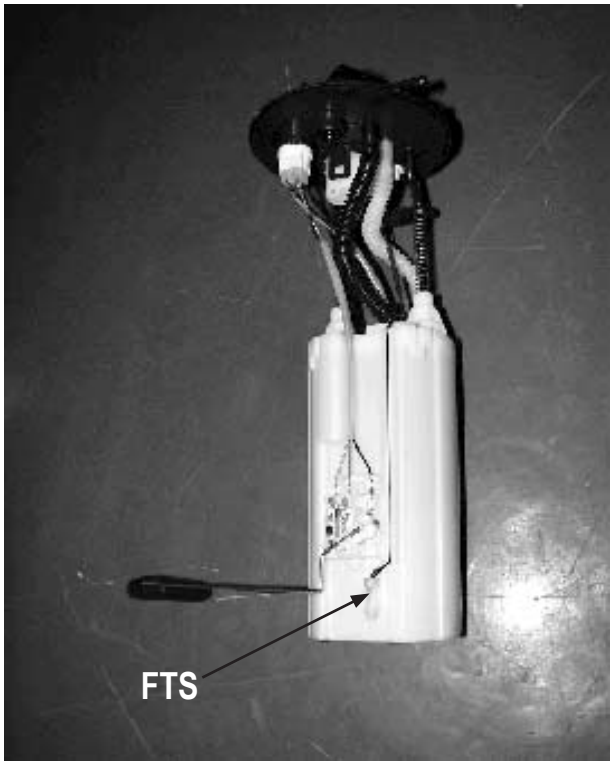
Fuel Level Sensor (FLS) and Fuel Temperature Sensor (FTS)

The ECM employs the **Fuel Level Sensor (FLS)** and the **Fuel Temperature Sensor (FTS)** during the .5mm leak detection portion of the EVAP test. Both sensors are located on the fuel delivery module. The FTS is a negative co-efficient sensor.

- FTS failures will cause the ECM to disable the .5mm portion of the EVAP test.
- FLS failures will not illuminate the MIL; a DTC will be stored and the ECM will assume 50% fuel level as a default value. (EVAP monitoring will not be affected by an FLS failure.)
- FLS output value (volts) will increase as fuel is added to the tank (range is 0-5VDC)

FTS Output Values

- 3.2-3.8V @ 32° F
- 2.3-2.9V @ 68° F
- 1.5-2.1V @ 104° F

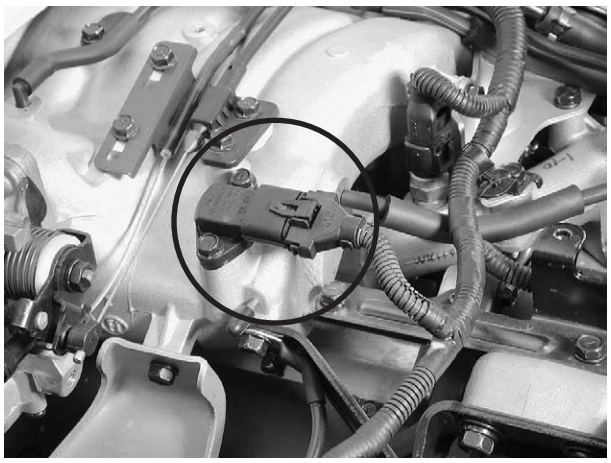


Manifold Absolute Pressure Sensor (MAP)

The ECM uses the ***Manifold Absolute Pressure Sensor (MAP)*** *signal to adapt the fuel system to variances caused by changes in altitude. The MAP is located on the passenger side of the intake plenum near the throttle body.*

MAP Output Values

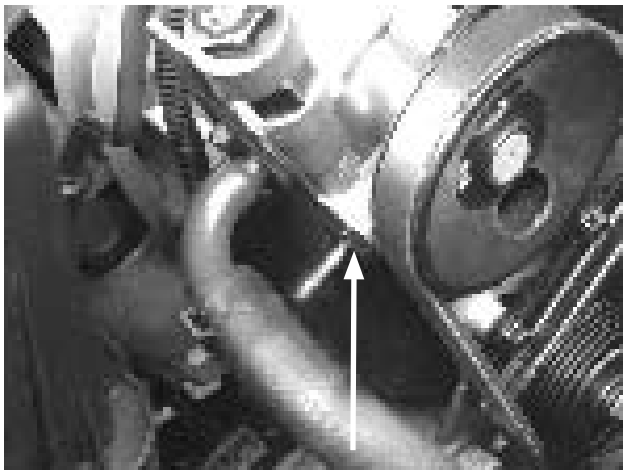
- 0.8-2.4V @ idle (warm engine)
- Hi-Scan Current Data displays MAP voltage and vacuum (inHG or inches of Mercury) readings.



Power Steering Pressure Switch (PSPS)

A **Power Steering Pressure Switch (PSPS)** is located on the power steering pump. The PSPS provides an ON/OFF signal which allows the ECM to make engine speed adjustments due to increased loading caused by turning the steering wheel at low engine speeds.

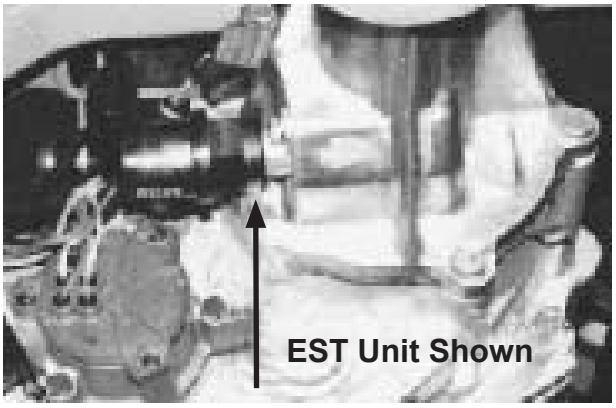
PSPS status (ON/OFF) is viewable in Hi-Scan Current Data.



Vehicle Speed Sensor (VSS)

The ***Vehicle Speed Sensor (VSS)*** *is a Hall-Effect unit. The ECM uses the digital output signal in addition to the speedometer, cruise control unit, and the speed-sensitive power steering (EX only). VSS signals are not utilized by the automatic transmission nor by either one of the transfer case control units (EST/TOD); separate sensors are employed to permit the TCM and EST/TOD to detect vehicle speed.*

- Vehicle Speed information is available in Hi-Scan Current Data.



Fast Idle Air Valve (FIAV)

The ECM controls **idle speed** via a stepper motor installed on the throttle body. Battery voltage is supplied to the ISC motor at two of the six terminals (the remaining four pins are for ECM control signals). A **Fast Idle Air Valve (FIAV)** facilitates cold engine idle-up functions by opening or closing based on coolant temperature. At 140 degrees Fahrenheit, the valve is fully closed. It is possible to make field adjustments to the base idle speed using the Hi-Scan Pro. Place the vehicle into an idle RPM adjusting mode and then manipulate the **Speed Adjusting Screw (SAS)** as needed.

ISC Resistance Values

- Terminals 5-4, 5-6, 1-2, 2-3: 29-38 ohms @ 68°F

ISC Step Data (Viewable in Hi-Scan Current Data)

- 120 steps are possible; the initial position is 80 steps. (set during 10-12 second power latch time at key OFF)

Idle Speed Target Data

- P, N range (A/C OFF): 800 +/- 100 RPM
- P, N range (A/C ON): 900 +/- 100 RPM
- D Range (A/C OFF or ON): 750 +/- 100 RPM

Speed Adjusting Screw (SAS)

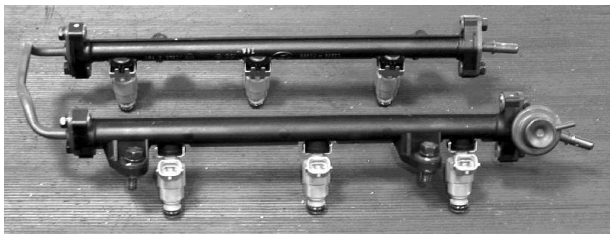
Idle Speed Control (ISC)

Fast Idle Air Valve (FIAV)

Fuel Injectors

The ECM sequentially activates the six **fuel injectors** through individual ground-controlled circuits. During initial engine cranking, the injectors are actuated simultaneously until the #1 cylinder is detected via the CMP signal. Each injector has four individual spray ports.

- Injection time (in milliseconds) for each cylinder bank can be seen with the Hi-Scan Current Data function.
- Injector resistance: 13-16 ohms at 68°F

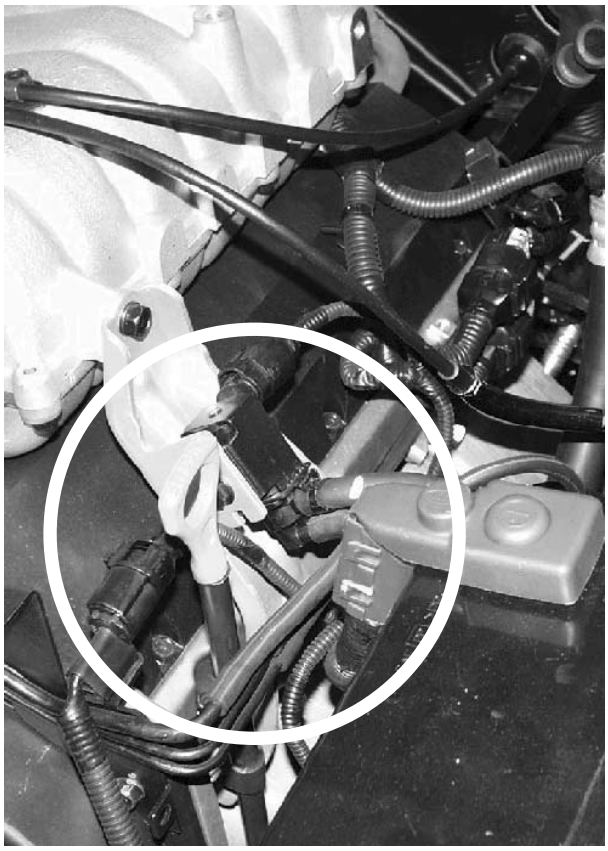


Purge Solenoid Valve (PSV)

The ECM controls the Purge Solenoid Valve (PSV) using a duty-cycle signal to facilitate canister purging. The PSV is also operated during EVAP leakage monitoring.

PSV Resistance Specification

- 30-34 ohms @ 68°F

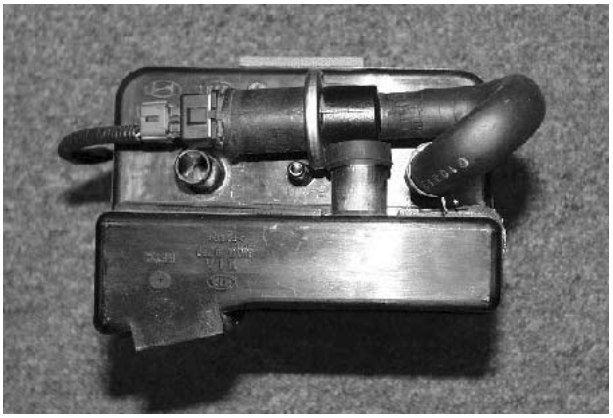


Canister Close Valve (CCV)

*The **Canister Close Valve (CCV)** is located on the EVAP canister which is underneath the vehicle forward of the fuel tank. The CCV is a normally open valve, and is electrically closed for the purposes of sealing the EVAP system for leak monitoring purposes.*

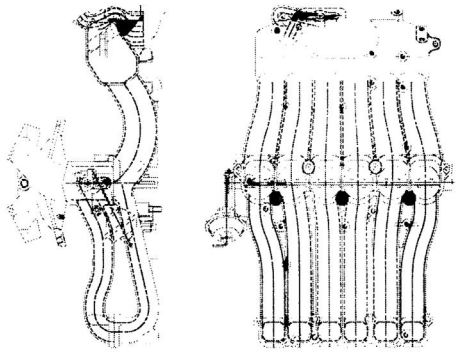
CCV Resistance Values

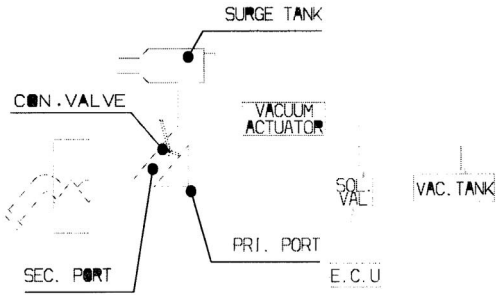
- 23-26 ohms @ 68°F

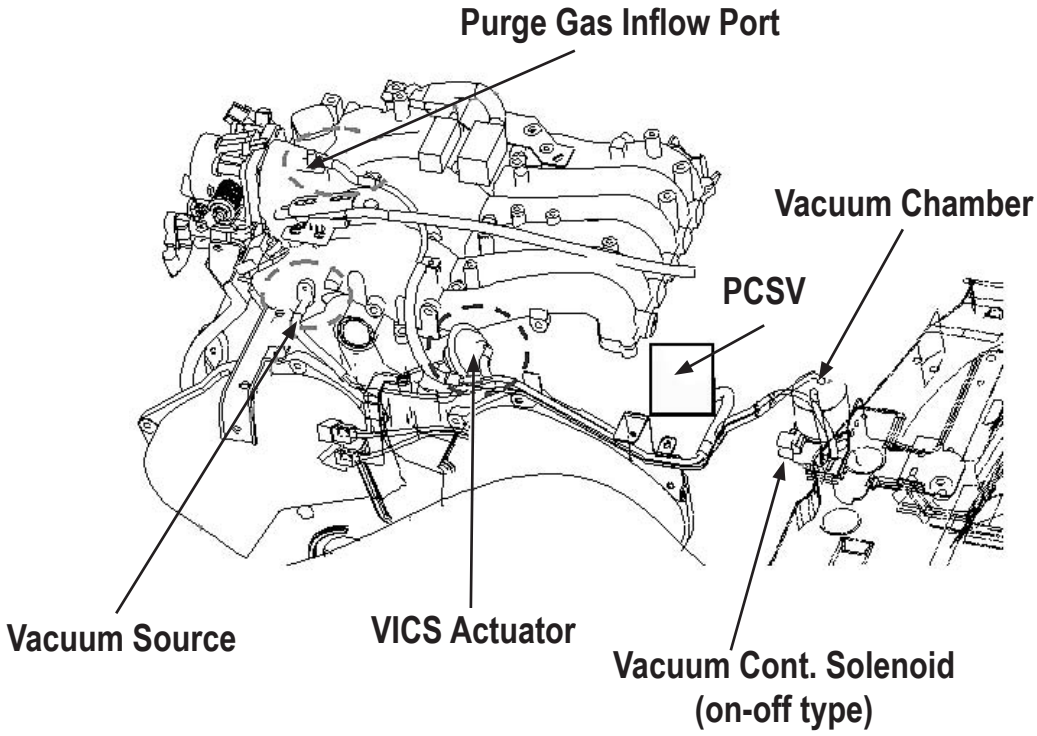


Variable Intake Control System (VICS)

Low to medium speed torque is boosted with a variable intake manifold controlled by the ECM via a **Variable Intake Control System. (VICS)**. The VICS consists of an actuator (operated by engine vacuum) and a solenoid which is turned ON (open) or OFF (closed) by the ECM (ground controlled) to allow vacuum to operate the VICS actuator. A vacuum chamber with a check valve is fitted to ensure a stable supply of vacuum to the VICS actuator. The system is designed to direct intake airflow through long runners below 3500 ± 100 RPM. Above 3500 RPM, the ECM activates the vacuum control solenoid, which in turn allows manifold vacuum to operate the VICS actuator; intake airflow is then redirected through shorter intake runners.

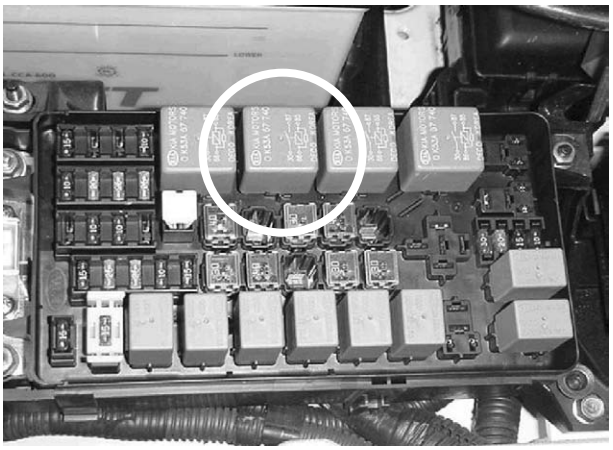






Main Relay

The **Main Relay** supplies power to sensors and actuators which require 12VDC, and provides main battery power to the ECM (keep-alive memory is maintained through a separate connection). The relay remains active for about 10-12 seconds at key OFF for adaptation value, ISC initialization, and fault status storage purposes. The main relay is ECM controlled.



Controller Area Network (CAN)

A **Controller Area Network (CAN)** allows the ECM and TCM on the 2003 Sorento to exchange data using two common data lines, rather than employing separate wiring for each shared signal. CAN data is transmitted in digital format at a transmission rate of 500kbit/second.

The ECM and TCM support individual DTC's for CAN communication failures. P1630 is a TCM CAN code; P1632 is an ECM Controller Area Network DTC.

OBD-II Monitoring Functions

The following monitoring functions are performed in accordance with OBD-II regulations:

- **Catalyst Efficiency Monitoring**
- **Misfire Monitoring**

Note: *The misfire monitor function does not detect rough road conditions via a Chassis Acceleration Sensor (Bosch) or Wheel Speed Sensor (Siemens); rough road detection is accomplished internally by the ECM, based on RPM and load values.*

- **Fuel system Monitoring (Fuel Trim)**
- **EVAP Monitoring—0.5mm leak detection capability**

Note: *EVAP testing on the 2003 Sorento is similar to the Sedona (vacuum). The ECM will NOT initiate an EVAP test on its own with the vehicle stationary at idle speed.*

The following are conditions for an ECM INITIATED EVAP test:

Large Leak Test (1mm and >1mm leak)

- Fuel Level: 15-85%
- ECT: >140°F
- IAT: < 140°F
- Vehicle Speed: >/= 19 MPH
- FTPS Voltage: 1.0-3.5V
- ECT at start: <140°F
- Load Value: 25-70%
- Engine Speed: >1500 RPM

Small Leak Test (.5mm)

- Fuel Temp: 32-113°F
- ECT at start: <140°F
- IAT: <140°F
- Time after start: 192 seconds (3min 12 sec)
- FTPS Voltage: 1.0-3.5V
- Fuel Level: 15-85%
- Vehicle speed: <37.5 MPH

Thermostat Monitoring

The engine must reach 170.6°F within a specified time period following engine start. The amount of elapsed time before thermostat monitoring takes place will vary depending on MAF, VSS, and engine load values (10-30 min).

Thermostat Monitoring Enable Conditions

- *ECT at start: 20-140*°F
- *IAT decrease after start: < 9*°F
- ECT at start –IAT at start: < 9°F
- VSS: > 10 MPH

Hi-Scan Pro Diagnosis

The 2003 Sorento is fitted with two **Data Link Connectors (DLC)**. A 20-pin DLC is installed in the engine compartment in addition to the J-1962 16-pin connector (OBD-II DLC). Forty-five Current Data items are available for viewing and/or flight recording. The following additional functions are supported:

Actuation Testing

Injectors may be individually cancelled with the engine running. The fuel pump, PSV, CCV, and radiator fan high /low speeds can be activated with key ON and engine NOT running.

EVAP Testing

The Hi-Scan Pro can be used to initiate an off-board EVAP system test. The vehicle must be in ***Park*** or ***Neutral*** and not moving (VSS=0) for this test to function properly. During the test, the engine speed will be set around 2500 RPM. Five minutes should elapse between EVAP test sequences, and the engine should be warmed up (ECT>176°F). Fuel level should be between 15% and 85% capacity. A blocked vent on the FTPS will give a false reading.

ECU ROM ID

Displays the ROM ID of the ECM.

Idle RPM Adjust Mode

The Hi-Scan can be utilized to place the vehicle into an idle RPM adjust mode. The Speed Adjusting Screw (SAS) on the throttle body can then be manipulated to adjust base engine RPM (see the Vehicle Emission Control Information Label under the hood for the correct specification).

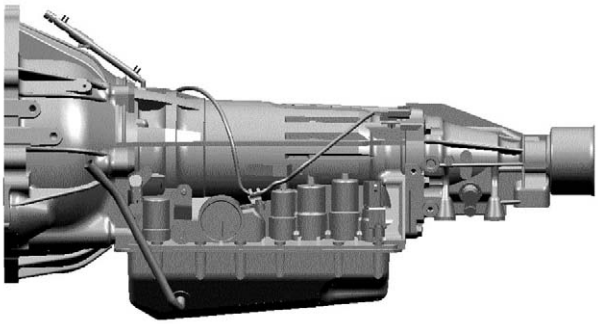
Special Service Tools

Tool Number & Name	Illustration	Use
Fuel Pressure Kit Adapter "D"		Connection of fuel pressure gauge to delivery pipe for measurement of fuel pressure
09353-24100 Fuel Pressure Gauge & Hose		

Section 5 • Transmission

Automatic Transmission

The Sorento **automatic transmission** is the Aisin Warner 30-40LEi Model, a four-speed, Electronically Controlled Automatic Transmission (ECAT) with a lock-up torque converter. Unlike the Sportage, which uses a throttle cable to control hydraulic pressure, the Sorento uses a pressure control solenoid valve. Various internal and external changes have been made to improve the transmission's performance:



- An input turbine engine speed sensor has been added to conform to new OBD-II regulations. The torque converter housing has been redesigned to accommodate the input speed sensor.
- The TCM is located under the steering column.
- Inside the transmission, the direct clutch disc surfaces now have a new wavy pattern to reduce engagement shock.
- The disc facing material on the other clutches has been changed to enhance shift quality.

Engine		3.5 V6
A/T Model		30-40LEi (AISIN AW)
General		4 speed transmission (line pressure control)
Maximum input torque (lbs/f)		77
Weight (lbs)		175.56
Components		3 clutches, 4 brakes,3 OWCs
Planetary gear		3 planetary gear sets (simple type)
Gear ratio	1,2,3,4/R	2.804, 1.531, 1.000, 0.705, 2.393
Shift mode		P-R-N-D-2-L / SNOW (2WD only)
ATF oil		Dexron III
ATF capacity (quarts)		9.8
Cooling type		Separate oil cooler in radiator

Fluid Service Intervals—Normal

- Inspect @ 7,500 miles or 7.5 months

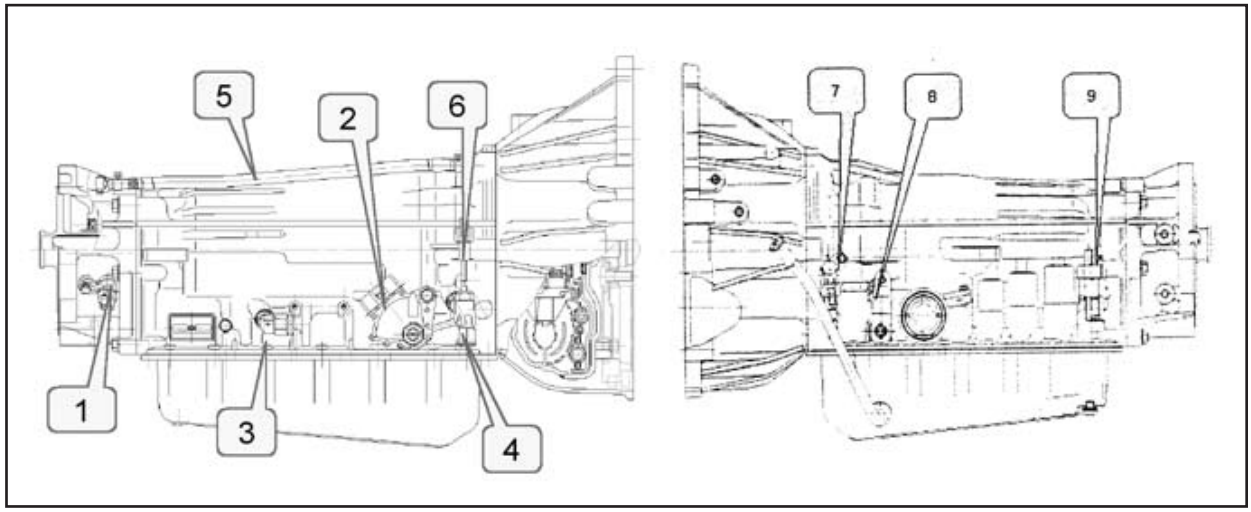
Fluid Service Intervals—Severe

- Inspect @ 7,500 miles or 7.5 months
- Replace @ 30,000 miles or 30 months

Non-serviceable screen—internal screen

Note: Fluid must be checked at operating temperature

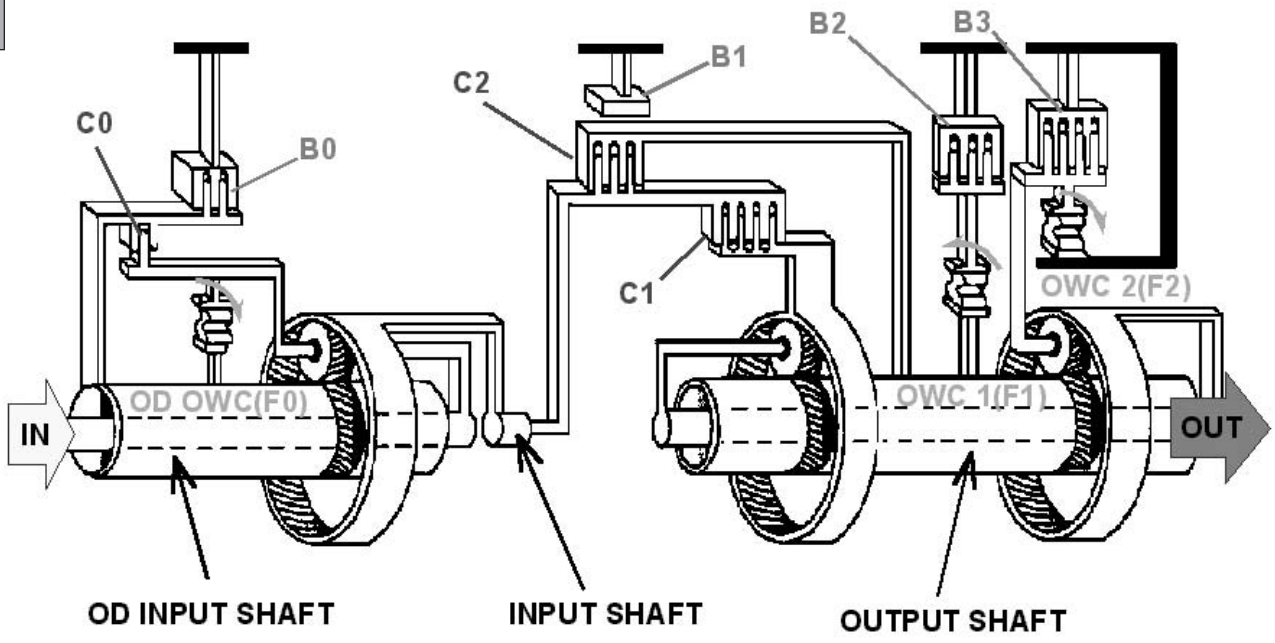
System Layout



	Item	Function
1	Output speed sensor	Detects output shaft revolution
2	Neutral switch	Detects “N” range (A/T) or “Neutral” range (M/T)
3	A/T inlet tube	From cooler to A/T
4	A/T outlet tube	From A/T to cooler
5	Air breather hose	For air ventilation inside transmission
6	Oil temperature sensor	Detects the oil temperature
7	Input speed sensor	Detects input shaft revolution
8	Outer lever	Connected to the control cable to change driving range
9	T/M wire	Solenoid valves and sensors connection

POSITION		SOLENOID			CLUTCH			BRAKE				O.W.C.			GEAR RATIO
		S1	S2	SL	C0	C1	C2	B0	B1	B2	B3	F0	F1	F2	
P		ON	OFF	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	-
R(V<7)		ON	OFF	OFF	ON	OFF	ON	OFF	OFF	OFF	ON	ON	OFF	OFF	2.393
R(V>=7)		ON	ON	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF	ON	OFF	OFF	-
N		ON	OFF	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	-
D	1st	ON	OFF	OFF	ON	ON	OFF	OFF	OFF	OFF	OFF	ON	OFF	ON OFF	2.804
	2nd	ON	ON	OFF	ON	ON	OFF	OFF	OFF	ON	OFF	ON	ON OFF	OFF	1.531
	3rd	OFF	ON	ON	ON	ON	ON	OFF	OFF	ON	OFF	ON	OFF	OFF	1.000
	4th	OFF	OFF	ON	OFF	ON	ON	ON	OFF	ON	OFF	OFF	OFF	OFF	0.705
2	1st	ON	OFF	OFF	ON	ON	OFF	OFF	OFF	OFF	OFF	ON	OFF	ON OFF	2.804
	2nd	ON	ON	OFF	ON	ON	OFF	OFF	ON	ON	OFF	ON	ON	OFF	1.531
	3rd	OFF	ON	OFF	ON	ON	ON	OFF	OFF	ON	OFF	ON	OFF	OFF	1.000
L	1st	ON	OFF	OFF	ON	ON	OFF	OFF	OFF	OFF	ON	ON	OFF	ON	2.804
	2nd	ON	ON	OFF	ON	ON	OFF	OFF	ON	ON	OFF	ON	ON	OFF	1.531

Output Shaft

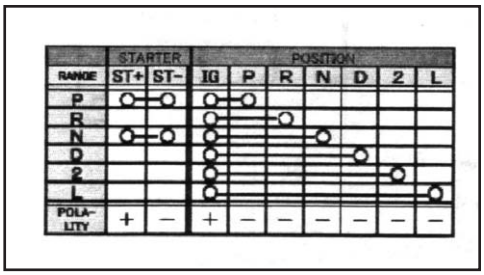


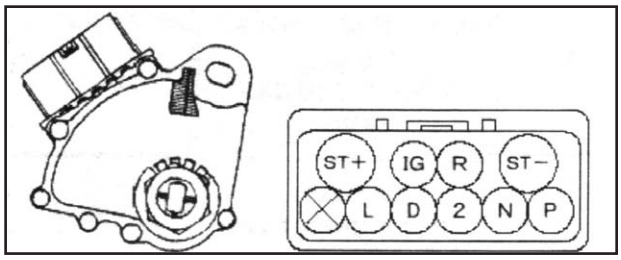
Electronic Control Parts and Their Operation

Neutral Start Switch (NSW)

The Neutral Start Switch (NSW) sends the automatic transmission's shift lever position to TCM.

- The NSW only allows the engine to start in "P" and "N".





The neutral start switch, which is also called an inhibitor switch, sends the shift position information to the TCM. To start an engine, the shift lever should be located in the N or P range.

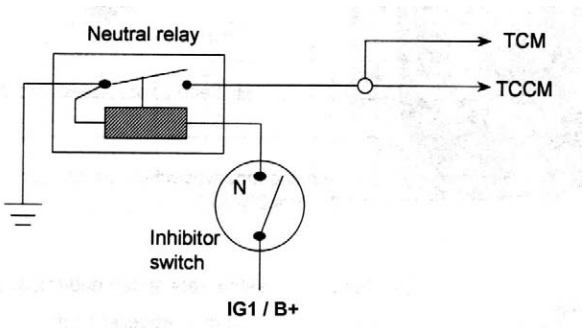
In the case of a switch malfunction or switch open or short:

- If no signal is detected, the TCM electrically controls the shift control solenoid valves according to the shift pattern. However, hydraulic pressure and engaged components are controlled by the manual valve location which is aligned with the shift lever. According to the location of the manual valve, the hydraulic connection inside the valve body operates relevant parts.

For example, if the **L** range is selected but there is no position signal coming from an inhibitor switch, the TCM recognizes this as the **D** range. It controls the ON/OFF combination of the shift control solenoid valves No. 1 and No. 2 according to the **D** range shift pattern. Without the signal from the **L** range, the transmission follows a **D** range shift pattern up to the second gear. The car transmission cannot be shifted up to the third and fourth gears.

A/T Neutral Relay

Automatic transaxle vehicles have an A/T neutral relay to detect the shift condition from "Auto Mode" to "Low Mode" (TOD) or 4H to 4L mode (EST). Due to the characteristics of the Transfer Case Control Module (TCCM), the 'N' signal (battery 12 volt) from the inhibitor switch cannot switch directly.



Oil Temperature Sensor (OT)

The Oil Temperature Sensor converts ATF temperature variation into electronic signals to transmit to the TCM. This information is necessary for shift control and Lock-up control, etc.

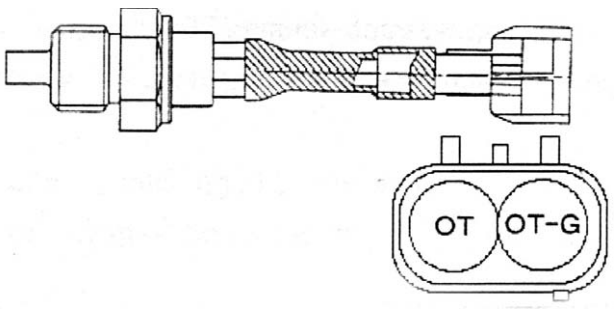
Resistance Specifications

- At 32°F resistance should be 1,884 –2,290 ohms.
- At 320°F resistance should be 19.2 – 22.2 ohms.

The oil temperature sensor is a **Negative Thermal Coefficient** (NTC) type of thermistor which detects ATF temperature coming from the torque converter where the transmission's oil temperature is the highest.

Oil viscosity varies depending on the oil temperature. This affects parts lubrication and shift feel so the TCM needs to change its shift pattern and lock-up control to reduce oil temperature when it gets too high. The TCM has a high mode (hot mode) and low mode shift pattern.

As a fail-safe, if an oil temperature sensor circuit is open or short, the TCM judges the oil temperature to be 392°F and inhibits the lock up control, and the high oil temperature shift pattern is then adapted.



Input Speed Sensor (CO)

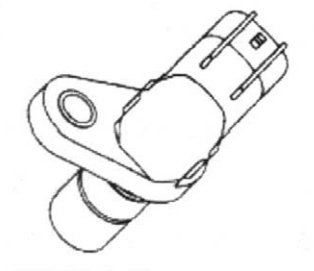
The **Input Speed Sensor (CO)** detects A/T input speed from the rotation speed of the over-drive direct clutch, and transmits this to the TCM. The input speed sensor will supply default data for gear shifting in case the output speed sensor fails. It also informs the TCM of the damper clutch operating status when the lock-up solenoid is ON.

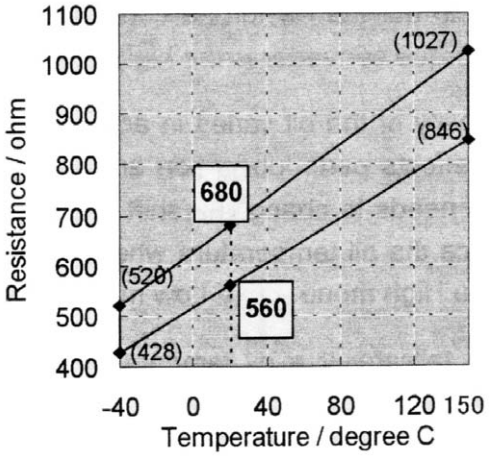
The CO monitors the rotation of the Over-Drive Direct Clutch (ODDC). The ODDC is engaged at first through the third gear. When the transmission is shifted into fourth gear, the ODDC disengages and the direct clutch's revolution begins to stop. In this way, the TCM receives feedback about fourth gear engagement or disengagement.

The input speed signal is a substitute data source for gear shifting in case the output speed sensor fails. It also indicates the damper clutch's operating state when the lock-up solenoid is ON.

When a damper clutch operates, the damper clutch directly couples with the torque converter's drive plate rotating at engine speed. Thus, input shaft speed is also the engine speed. If the damper clutch fails or hydraulic pressure is not applied because the lock-up solenoid malfunctions, the damper clutch will slip or not operate. This will result in a speed difference between the engine speed and the input shaft speed.

The damper clutch operation can be checked by an input sensor signal.



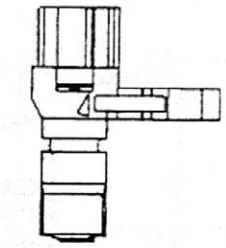


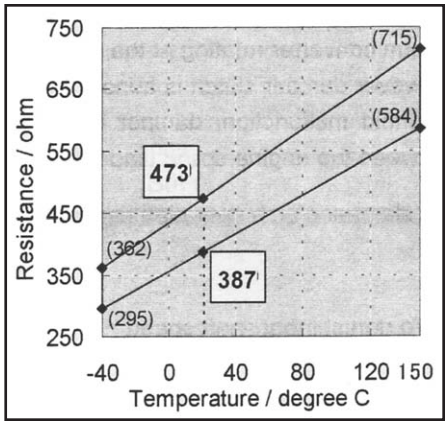
560 - 680 ohm (68°F)

Output Speed Sensor

The **Output Speed Sensor** detects the rotation of the output shaft. The output speed signal operates in conjunction with the TPS data to get an accurate gear shifting pattern while driving.

If this sensor fails, the MIL lamp comes on. Gear shifting can be done normally using the input speed sensor signal. Additionally, the damper clutch control, line pressure control, and torque reduction control all will not operate.





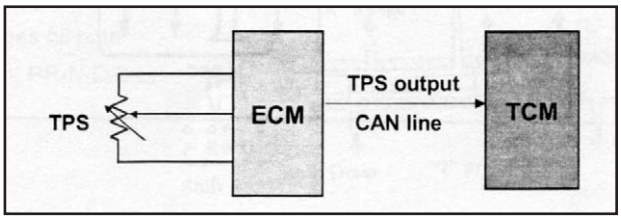
387 - 473 ohm (68°F)

Throttle Position Sensor (TPS)

The **Throttle Position Sensor (TPS)** is the most important component used to determine shift timing control. If the TPS sensor fails, the TPS data will default to 0% and maximum line pressure will be applied to protect all operating components of the transmission. Also, the torque reduction control will not operate.

The ECM sends the TPS a signal via a CAN bus communication line to the TCM. Without the CAN communication, an independent pin and wiring would be needed to receive sensor information from the ECM. The TPS information is used to control line pressure through the line pressure control valve.

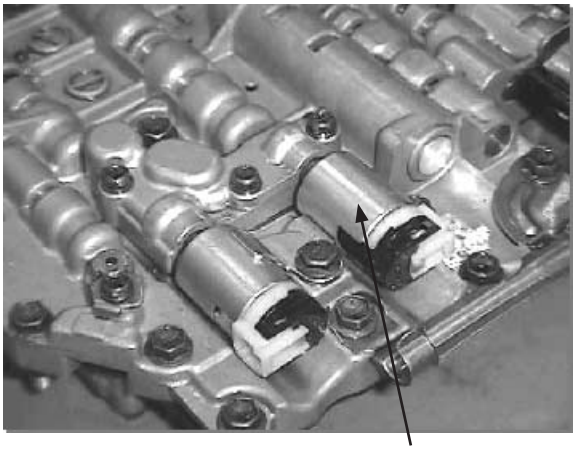
Resistance values for this sensor are: 3.3-3.7 ohms at 156°F.



Shift Solenoid No. 1 & No. 2 (S1, S2)

Shift solenoids No. 1 and No. 2 are controlled by the signal from the TCM. Shift Solenoid valve is the normally closed (NC) type. When the solenoid is ON, solenoid valve is open.

Gear	SCSV No. 1	SCSV No. 2
1st	ON	OFF
2nd	ON	ON
3rd	OFF	ON
4th	OFF	OFF

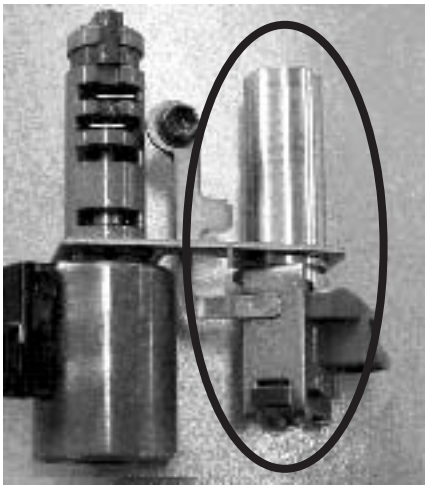


Shift Control Solenoid Valve

Lock-up Solenoid (SL)

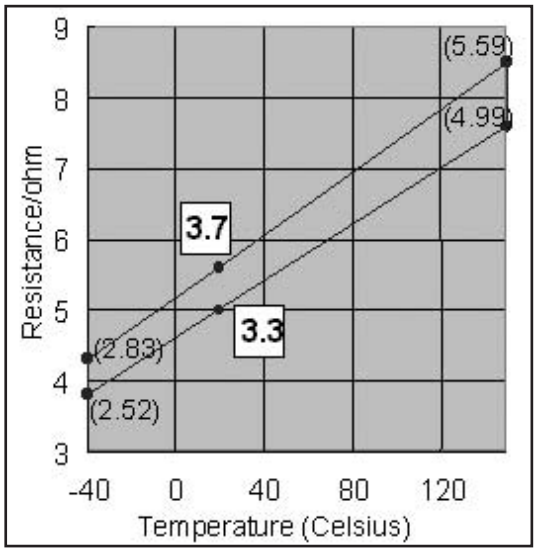
This solenoid is a Normally Open (NO) type. According to each lock-up shift schedule, the TCM sends signals to the lock-up solenoid valve. ON/OFF control of the lock-up solenoid by the TCM is based on the vehicle speed and the throttle opening.

According to the TPS opening angle, the lock-up solenoid valve controls the oil pressure to the primary regulator valve and generates proper line pressure which matches engine load.

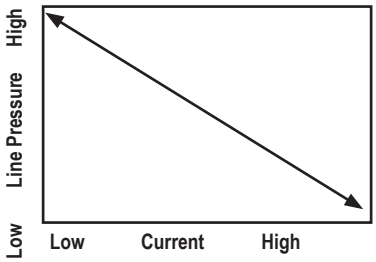


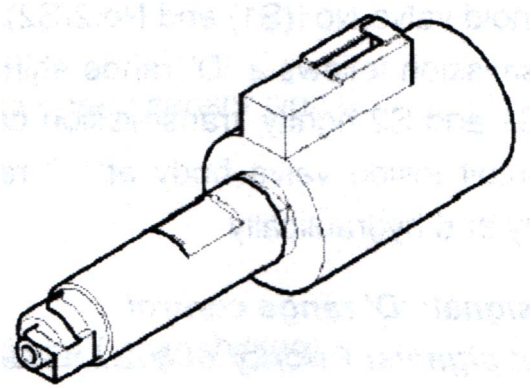
Line Pressure Control Solenoid

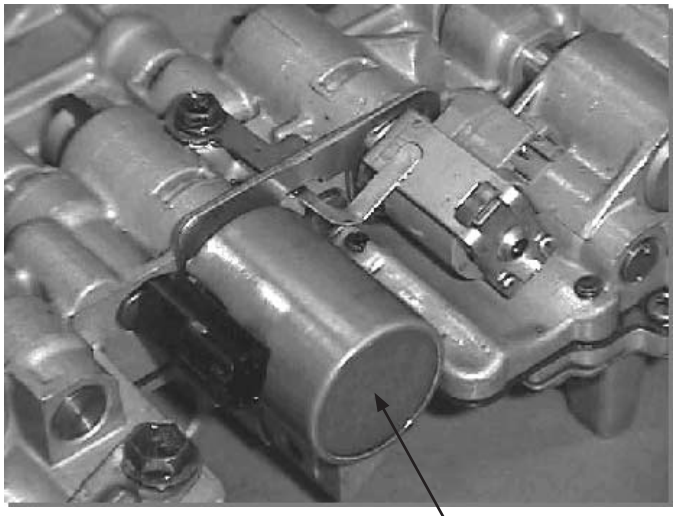
The Line Pressure Control Solenoid (SLT) controls linear throttle pressure by control signal from TCM and line pressure for clutches and brakes to reduce shift shock.



3.3 - 3.7 ohm (68°F)



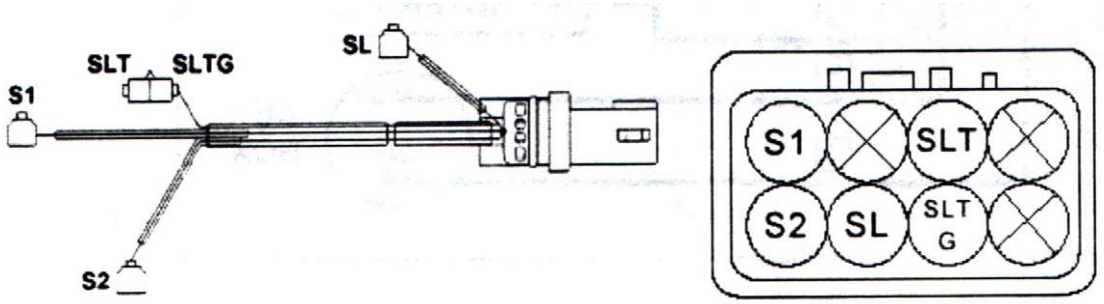




Pressure Control Solenoid Valve

Shift Solenoid No. 1 & No. 2 Wiring

The wiring for the Shift Solenoid No. 1, No.2, the Lock-up Solenoid and SLT are assembled in one connector, and are installed in the A/T case.

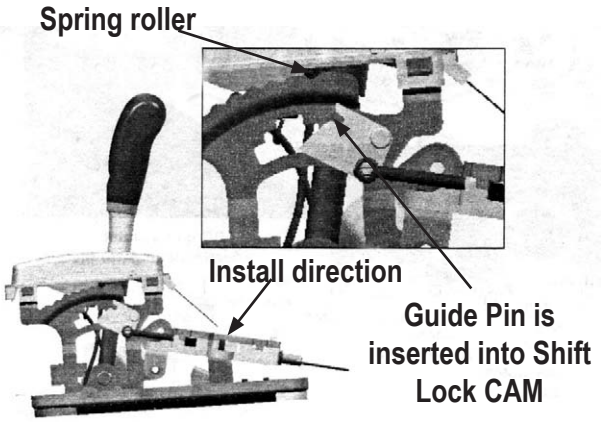


Shift Lock Device Installation

1. Procedure to install the lock cam.
- Make sure to move shift lever to position "P" and install lock cam as figure.

2. Procedure for adjusting shift lock cable.
- Check that lock cam is located in position.
- Install shift lock cable in position as figure.
- Temporarily install shift lock cable to A/T lever assembly as shown in figure. Securely insert cable end into fixing pin of cam.
- After checking that a portion of cable end touches cable fixing pin of Rock cam, fix shift lock cable to A/T lever.

3. Checking that procedure for installing the shift lock is correct.
- When the brake pedal is not depressed, push button of the shift lever at "P" position cannot be operated. (Shift lever cannot be shifted to the other positions from "P".) Push button can be operated at the other positions except "P".
- When brake pedal stroke is 30 mm (with shift lever at "P" position), push button should be operated without catching and shift lever can be shifted smoothly to other positions from "P".
- When brake pedal is not depressed, shift lever should shift smoothly to "P" position from other positions.
- Shift lever must operate smoothly without catching, at all positions.
- If shift lever is shifted into "P" position, ignition key must turn to "LOCK" position smoothly.

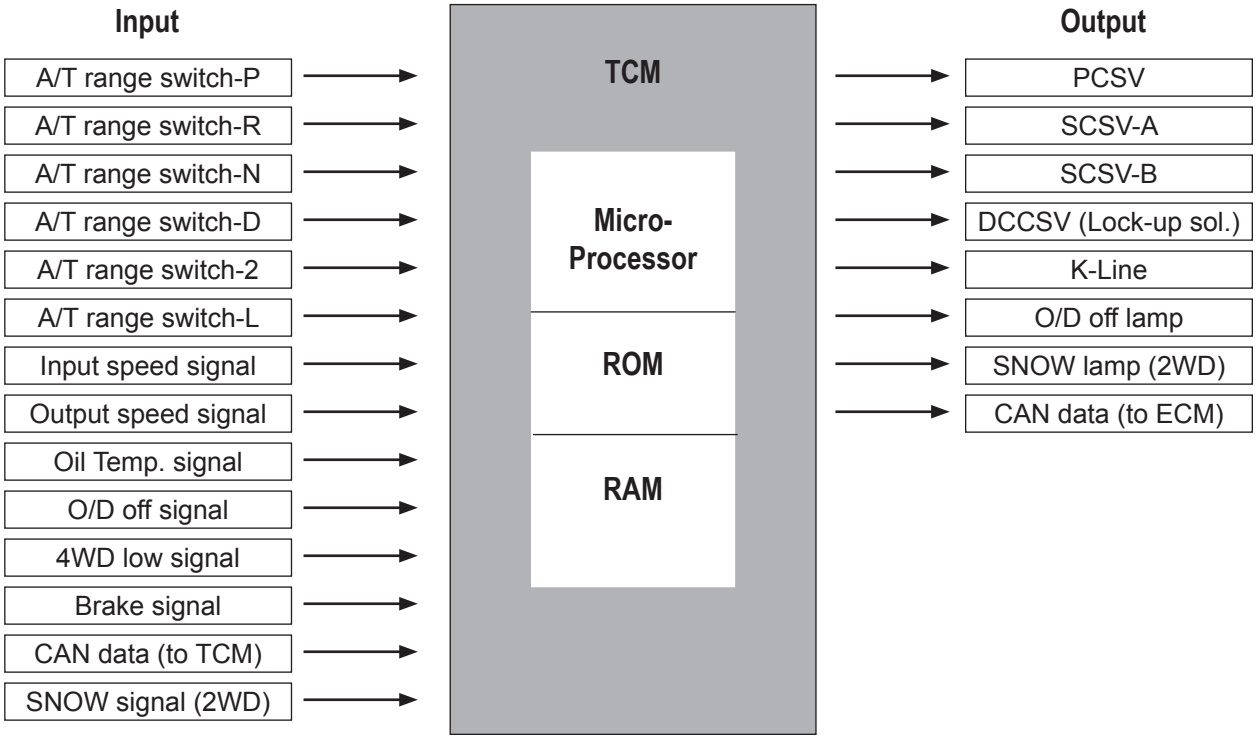


TCM Logic

The basic part of all electronic control systems is the TCM. The TCM is an electronic device that receives information, stores information, and communicates information. To a TCM, certain voltage and current values mean something and based on these values the TCM is informed.

The TCM receives information from a variety of input devices that send voltage signals to the TCM. These signals tell the TCM the current condition of a particular part or the conditions that a particular part is operating in. After the TCM receives these signals, it stores them and interprets the signals by comparing the values to data it has in its memory. If an action is required, the TCM will send out a voltage signal to the device, causing it to respond to the appropriate component.

This entire process describes the operation of an electronic system: Information is received by a microprocessor from input sensors, the TCM processes the information, then sends commands to the output devices. It monitors its own work and checks to see if its commands resulted in the expected results.

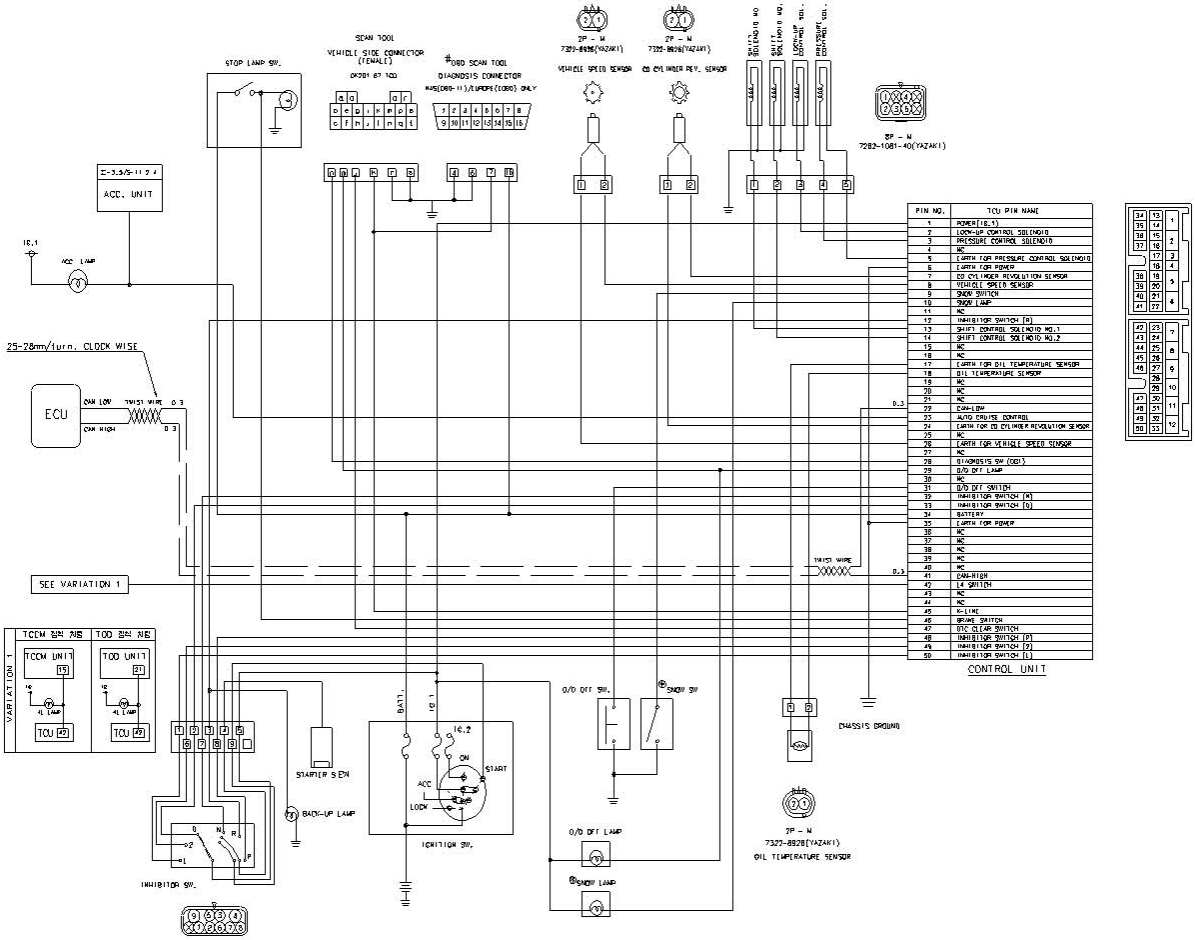


TCM Input and Output Terminal Voltage Table (Accurate at time of printing; data used for world market.)

No.	Pin Name	Condition	Input & Output Signal		Remark
			Type	Level	
13	SCSV 1 (1st, 2nd speed operation)	Driving (P,N/1st/2nd/3rd/4th speed)	Frequency	Vbatt - DV Io : 1.9A MAX	SCSV1: Shift Control Solenoid Valve No. 1
14	SCSV 2 (2nd-3rd speed operation)	Driving (P,N/1st/2nd/3rd/4th speed)	Frequency	Vbatt - DV Io : 1.9A MAX	SCSV2: Shift Control Solenoid Valve No. 2
9	Snow SW (2wd vehicle)	SW OFF	Frequency	V_{GND} -0.3 - 2V	
		SW ON	DC	V (IG.1)	
7	CD Cylinder Rev. SNSR (over-drive clutch drum)	Idle	Pulse	V_{HI} - V_{LOW} 16 Pulse/CO cylinder rev.	< - Input speed sensor
8	Vehicle Speed Sensor	Driving	Pulse	V_{HI} - V_{LOW} 12 Pulse/TM rev.	< - Output speed
31	O/D OFF Switch	OFF SW OFF	DC	V(IG 1)	
		OFF SW ON	DC	V_{GND} -0.3 - 2V	
48	Inhibitor Switch (P)	P	DC	Vbatt	
		R/N/D/2/L	DC	Below 0.8V	
12	Inhibitor Switch (R)	R	DC	Vbatt	
		P/N/D/2/L	DC	Below 0.8 V	
34	Battery	Ignition OFF	DC	Vbatt	
		Ignition ON	DC	Vbatt	
2	Lock-Up Solenoid	Driving (over 28 MPH)	Frequency	Vbatt - DV Lo : 1.9A MAX	< - Torque converter solenoid valve
3	PCSV	Idle		Current control Lo : 1A MAX	Pressure control solenoid valve

No.	Pin Name	Condition	Input & Output Signal		Remark
			Type	Level	
5	Earth for PCSY				
47	DTC Clear Switch	S/W OFF	DC	V (ignition 2)	
		S/W ON	DC	V_{GND} -0.3 - 2V	
18	Oil Temp. Sensor	Ignition OFF	DC	DV	
		Idle	DC	0 - 5V	
24	Earth for CO Cylinder Rev. Sensor				
26	Earth for VSS				
42	L4 Switch (4wd Vehicle)	SW OFF	DC	V(IG 1)	
		SW ON	DC	V_{GND} -0.3 - 1.0V	
10	Snow Lamp (2wd Vehicle)	Lamp OFF	DC	Vbatt	
		Lamp ON	DC	1.5V MAX	
29	O/D OFF Lamp	Lamp OFF	DC	Vbatt	
		Lamp ON	DC	1.5V MAX	
32	Inhibitor Switch (N)	N	DC	Vbatt	
		P/R/D/2/L	DC	Below 0.8V	
33	Inhibitor Switch (D)	D	DC	Vbatt	
		P/R/N/2/L	DC	Below 0.8V	
1	Power (Ignition 1)	Ignition OFF	DC	0V	
		Ignition ON	DC	9V - 16V	
6	Earth for Power				
46	Brake SW	Switch OFF	DC	V_{GND} -0.3 - 2V	
		Switch ON	DC	Vbatt 2.0 - Vbatt	
35	Earth for Power				
17	Earth for OTS				OTS: Oil Temp. Sensor

No.	Pin Name	Condition	Input & Output Signal		Remark
			Type	Level	
45	K-Line	Continually (10.4Kbps)	Pulse	Logic "0" : Vbatt 20% ↓	
				Logic "1" : Vbatt 80% ↑	
28	Diag. Switch	S/W OFF	DC	V (Ignition 1)	
		S/W ON	DC	V_{GND} -0.3 - 1.0V	
49	Inhibitor Switch (2)	2	DC	Vbatt	
		P/R/N/D/L	DC	Below 0.8V	
50	Inhibitor Switch (L)	L	DC	Vbatt	
		P/R/N/D/2	DC	Below 0.8V	
23	Cruise Control (∑3.5/S-II 2.4)	ACC OFF		V (Ignition 1)	
		ACC ON		V_{GND} -0.3 - 1.5V	
41	CAN (High)	Continually (500Kbit/s)			
22	CAN (Low)	Continually (500Kbit/s)			



Shift Control

Shifting is based on inputs to a computer from various sensors, such as engine temperature, engine speed, throttle position, oil temperature, and gear selector position. The TCM compares the information from the sensors against the shifting instructions programmed into it. The TCM then controls the appropriate solenoid valves to provide optimum shift timing.

However, main shifting is made by the TPS and the output speed sensor signal which can be calculated as vehicle speed. The input speed sensor signal is used to monitor the fourth gear engagement.

In case of TPS sensor failure, the current data display in the HSP will display 0%. Maximum line pressure is applied to the operating components to protect the transmission and torque reduction control will not operate.

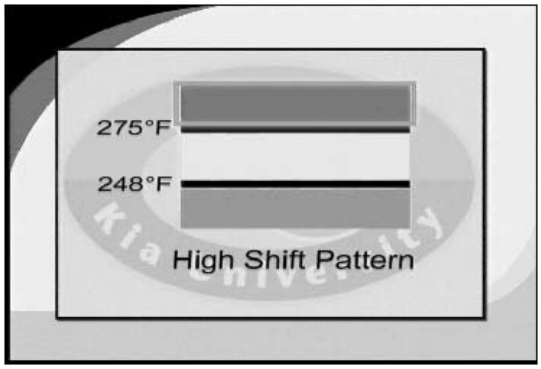
In case of output speed sensor failure, input speed data is used for shifting. Damper clutch control, line pressure, and torque reduction control will not operate.

Driving Control

Normal shift pattern in D range, up-shifting and down-shifting is available in all ranges (1st gear <-> 4th gear) except when 4 low mode is selected by a driver.

The shift pattern for hot oil mode starts when the old temperature is over 275°F. In this mode, lock-up control will not operate and engaging time for low speed will occur at a lower RPM.

Snow mode was called "Hold mode" on the Sportage. When this mode is selected using a button on the shifter, the vehicle starts from second gear to prevent the spinning of driving wheels on the slippery surface. Snow mode is only available for 2WD vehicles only.



High ATF Temperature Control

When the ATF temperature exceeds 275°F, the TCM changes the shift pattern automatically to further avoid ATF temperature increase.

This **hot mode** situation can happen while the vehicle is moving up a steep slope or while towing. The TCM changes the shift pattern into a High ATF Temperature shift pattern extending the low gear range while rendering the damper clutch non-operational.

- ATF temp. >=275°F resulting in a High ATF Temperature shift pattern
- ATF temp. <= 248°F will result in a normal shift pattern

Damper Clutch Control

The **Damper Clutch** or lock-up clutch is engaged for less fuel consumption while driving and to reduce exhaust gas emissions.

Squat Control

When the shift lever is moved from "N" to "D", the **Squat Control** operation temporarily shifts to 3rd gear to reduce shifting shock and a "squatting" vehicle.

Engine Torque Reduction (ETR) and Line Pressure Control (LPC)

Engine torque reduction control improves shift quality due to sending torque reduction request signal from TCM to ECM and reducing engine torque while shifting "N" to "D", "N" to "R" as well as shifting 1-2-3-4.

Note: The TCM has no information of real (current) engine torque, but through the calibration work at each condition in the actual vehicle for up- and down-shift, the TCM determines the value by how much the engine torque has to be reduced.

Line pressure control improves shift quality due to controllable line pressure while shifting "N" to "D", "N" to "R" as well as shifting 1-2-3-4.

Note: Line pressure control changes according to the current gear position, TPS value, oil temperature.

Reverse Inhibition Control

Should a driver accidentally shift to "R" while driving forward, the TCM does not engage the reverse gear until certain conditions are satisfied. This safety feature was designed into the TCM logic to prevent an accidental shift from Drive to Reverse while driving.

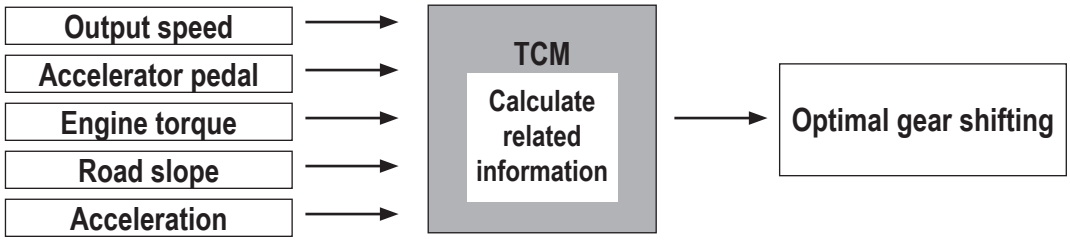
Adaptive Shift Control

Purpose

- Optimal shift control according to the road and driving condition.

Functions

- Up hill mode: To prevent frequent gear shifting and improve performance and fuel consumption.
- Down hill mode: Use engine braking as a brake for improved driving stability.



Adaptive Shift Control (Uphill Mode)

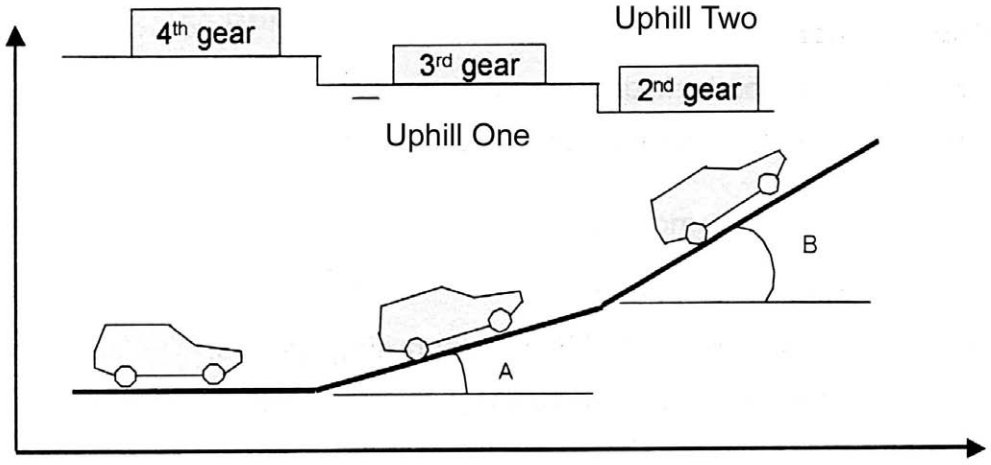
When the accelerator pedal is depressed while the vehicle is driving uphill, if the TCM were to up-shift it would result in poor acceleration. Uphill mode prevents frequent up-shifting to maintain driving force during acceleration.

There are two up-slope modes which change shift patterns:

- Hill One mode *engages* when the road slope exceeds 8% gradient for two seconds.
- Hill One mode *disengages* when the road slope is 5.5% or less for one second.
- Hill Two mode *engages* when the road slope exceeds 15% gradient for two seconds.
- Hill Two mode *disengages* when the road slope is 12% or less for one second.

The sensors used to determine optimal gear shifting are the VSS, TPS, and MAF.

If the vehicle speed remains constant while TPS angle and load increase, the TCM will assume the vehicle is traveling uphill and will respond with either the up slope one or slope two modes. The mode with which the TCM responds depends on the TPS angle and engine load.



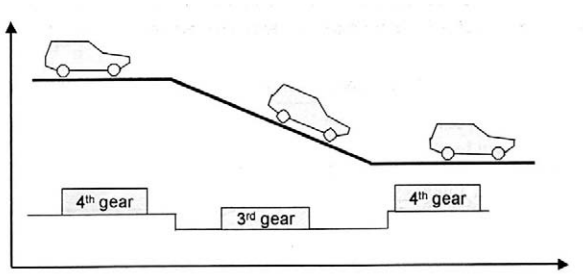
Adaptive Shift Control

Adaptive Shift Control (Down Slope Mode)

While driving downhill, the engine brake operates automatically according to the accelerator position and braking conditions at a certain slope degree:

- Down Slope mode *engages* when road slope exceeds 4.5% gradient down slope occurs for longer than 1 second.
- Down Slope mode *disengages* when road slope is 3.5% or less.

If the vehicle speed increases while TPS angle is at zero and the brake is applied, the TCM will assume the vehicle is traveling downhill and respond



Coast Down Control

Coast Down Control is used for 3→2 and 2→1 shifting.

When a vehicle starts and accelerates, the one-way clutch is engaged in 1st gear and 2nd gear. Acceleration means engine speed rotates faster than the output speed. Once a vehicle moves past the moment of inertia without acceleration, output speed is faster than the engine speed. At this moment, the one-way clutch rotates freely.

The TCM performs a Coast Down Control using the characteristics of the One-Way Clutch (OWC). Coast Down Control prevents a shift shock caused by deceleration into a low speed gear. With this control, down-shift engagement from 3rd to 2nd, 2nd to 1st gears is reduced with the 1st the 2nd gears extended more. Therefore a down-shift to 2nd gear or 1st gear can occur before the OWC is engaged which will result in reduced shifting shock caused.

Coast Down Control Start Conditions

- Brake switch is ON (when the foot brake is applied)
- Engine is idle (when the accelerator pedal is not used)
- D or 2 range.

Coast Down Control Cancellation Conditions

- After one second after the brake is disengaged.
- TPS>0%

Trouble-shooting/ Diagnosis

Stall Test

Purpose

- To check the slip of components and overall performance of the transmission.

Caution

- Do not test for longer than five seconds.
- Take at least one minute to idle in neutral between tests.

Stall RPM

- Sigma 3.5: 2520 RPM

Procedure

- Check ATF fluid level.
- Hook up transmission pressure tester to test port on the side of the transmission.
- Check for oil leaks at test port after starting vehicle.
- Take left foot and apply brake firmly.
- Set parking brake.
- Shift transmission into D range.
- Take right foot and apply throttle pressure for no more than five seconds.
- The test is the same for reverse except technician must wait at least one minute between testing.

Range	Components	Diagnosis	
		Stall RPM	Possible Cause
D range only	C1 C0 F2	High	1. C2 slip 2. F2 slip 3. Less line pressure
R range only	C2 C0 B3 F0	High	1. C2 slip 2. B3 slip 3. Less line pressure
D & R both ranges		Low	1. Less engine power 2. Poor OWC of inside T/C
		High	Poor oil pump

Time Lag Test

This is the same procedure as stall except there is no throttle application.

Time lag is the time until slight shock can be felt when the shift lever is shifted from "N" to "D" and from "N" to "R" while engine is idling. The time lag test can inspect the hydraulic condition clutch/brake condition.

- The technician must wait one minute between tests.
- Wheels must be locked during this test.
- Measure time lag by using stop watch from moment shift lever is shifted from "N" to "D" and "N" to "R" until moment slight shock is felt.
- Time lag spec: "N" to "D" no more than .7 seconds, "N" to "R" no more than 1.2 seconds.
- Take three measurements and take the average value.

Results

- Longer than spec from "N" to "D" = lower line pressure, forward clutch failure (slipping), number 2 one way clutch failure.
- Longer than spec from "N" to "R" = lower line pressure, direct clutch failure (slipping), first and reverse brake failure (slipping).

Trouble-shooting/ Diagnosis

Automatic Transmission Line Pressure Test

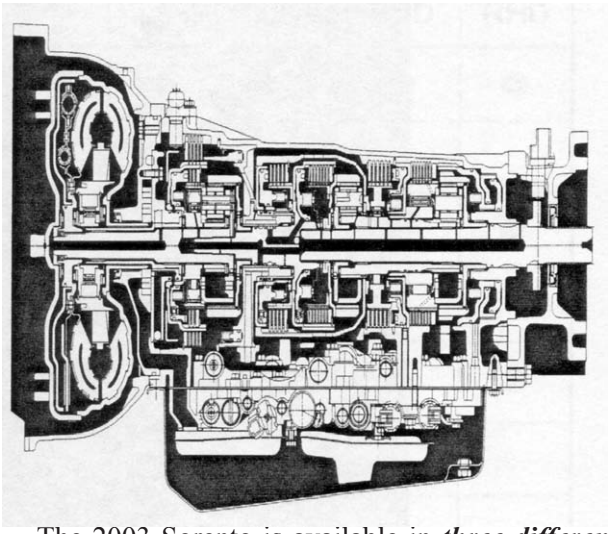
1. Connect the SST to line pressure inspection port of transmission case.
2. Shift the selector lever to "D" range.
3. Read the oil pressure at engine idle speed.
4. Depress the brake pedal firmly with the left and gradually depress the accelerator pedal with the right foot.
5. Read the oil pressure as soon as the engine speed becomes constant, then release the accelerator pedal.

   Note: Steps 4 and 5 must be performed within five seconds.
6. Shift the selector lever to "N" range and run the engine at idle speed for at least one minute.
7. Read the line pressures at engine idle and stall speed for "R" range in the procedure described above.

Shift position	Engine speed	Pressure psi (kg/cm²)
D	Idle	57-65 (4.0 - 4.6)
	Stall	166-188 (11.7 - 13.2)
R	Idle	88-102 (6.2 - 7.2)
	Stall	221-270 (15.6 - 19.0)

Evaluation of Line Pressure Test Condition		Possible Cause
Below standard	In "D" and "R" ranges	Defective or stuck the throttle valve Defective or stuck the regulator valve Defective the oil pump OD clutch slipping
	In "D" range only	Fluid leakage in the "D" range line pressure hydraulic circuit Forward clutch slipping OD clutch slipping
	In "R" range only	Fluid leakage in the "R" range line pressure hydraulic circuit Direct clutch slipping Defective low & reverse brake
Excessive line pressure at idle		Defective or stuck the throttle valve Defective or stuck the regulator valve

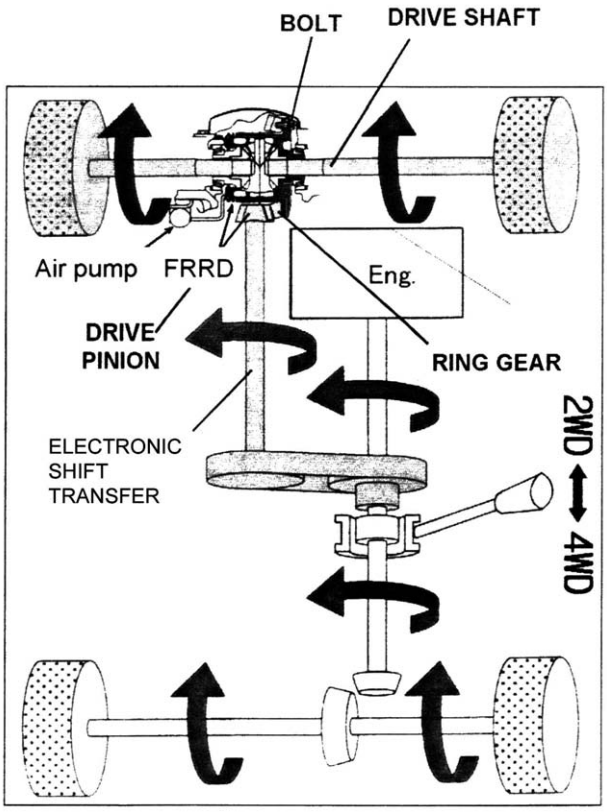
General Information

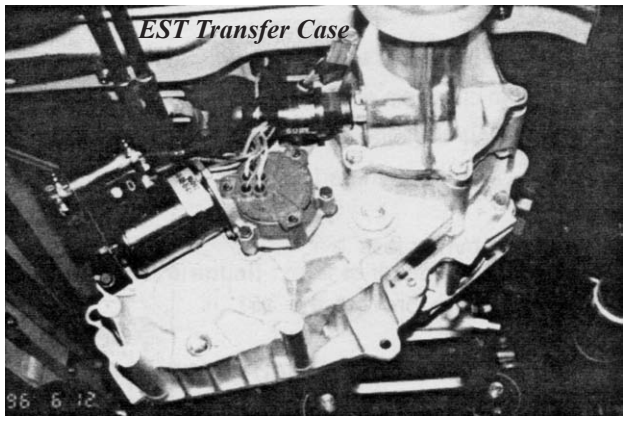


The 2003 Sorento is available in ***three different powertrain configurations***.

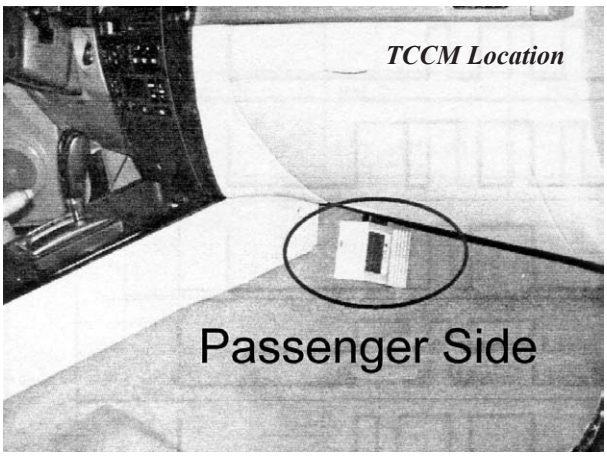
The ***first configuration*** is a conventional rear wheel, **two-wheel-drive** powered by a Sigma 3.5L V6 gasoline engine coupled to an Aisin-Warner 30-40 LEI, four-speed, electronically controlled, automatic transmission.

The ***second configuration*** utilizes the same engine and transmission to power the vehicle equipped with **Electronic Shift Transfer (EST)**, a part-time four-wheel-drive system. The EST utilizes a **Free Running Differential (FRRD)** to adapt the front axle to **Shift on the Fly (SOF)**. The driver can activate the high range of the four-wheel-drive system at speeds up to 50 mph (80km/h).





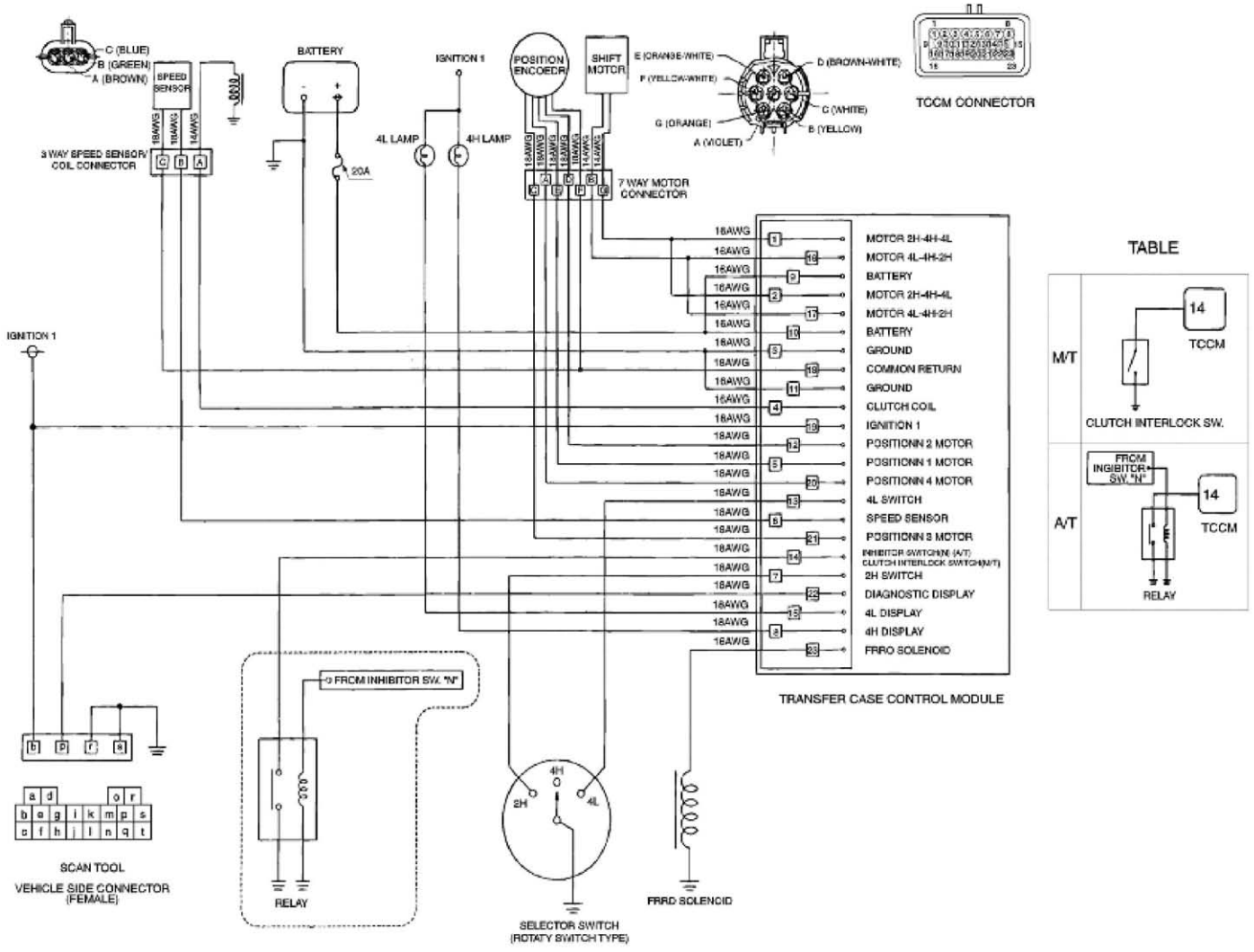
When the driver rotates the **Mode Selection Switch** on the instrument panel from **2H** to **4H,** the FRRD air pump motor is energized and the shift motor is activated. The FRRD system uses pressurized air from ***an electrically operated air pump to activate and de-activate a dog clutch in the front differential***. The electric air pump is located in front of, and below, the vehicle battery in the engine compartment. When 4WD is selected, the air pump energizes and expands the dog clutch activator to apply pressure to the clutch. As the clutch engages, it causes the ring gear carrier of the front differential to rotate which in turn rotates the front drive pinion. This causes the front propeller shaft to rotate to synchronize the speed of the shaft with the gears in the transfer case. As the speed of all of the related components synchronizes, the **Transfer Case Control Module (TCCM)** activates the shift motor to en-



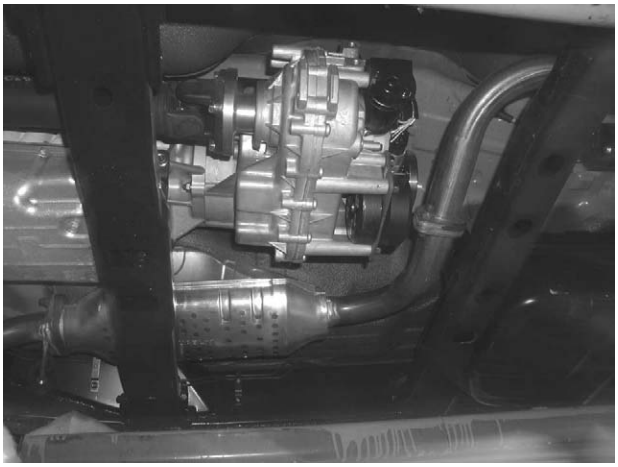
gage four-wheel-drive in the transfer case. Once the four-wheel-drive engages, the **4H Indicator Light** will illuminate steadily on the instrument panel. The vehicle may now be operated on soft or slippery surfaces with the rear wheels pushing the vehicle and the front wheels pulling to add safety and stability.

The part-time four-wheel drive system also has a **low range feature** to provide the operator with greater torque to turn the wheels when less vehicle speed is required. To engage the **4L** range of operation, the driver needs only 1) stop the vehicle, 2) place the gear selector in 'N', and 3) rotate the mode selection switch to the 4L position. The shift motor causes a gear change in the transfer case that will provide a gear reduction for the transfer case output. When the gear change has been completed successfully, the **4L Indicator Light** will illuminate steadily on the instrument panel. If the vehicle had previously been in **2H**, the FRRD will automatically engage the front differential and axles. To prevent dirt or moisture from being forced into the front differential with a failure of the clutch seals, the FRRD system utilizes pressurized air to activate the internal dog clutch rather than vacuum control. In the event of a suspected malfunction, the High Scan Pro is a valuable diagnostic tool.

Wiring Diagram



Active Torque Transfer System (ATT)

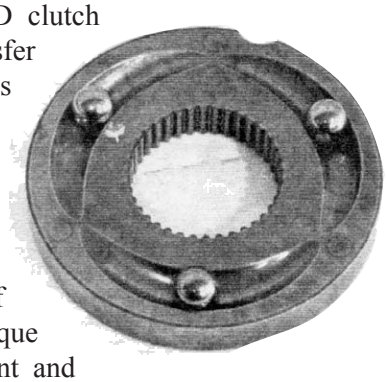


The ***third available powertrain*** configuration for the 2003 Sorento is an intelligent full-time four-wheel-drive system that utilizes an Active Torque Transfer system (ATT), commonly known as **Torque on Demand (TOD)**®. The TOD system uses a transfer case with a ***magnetically operated*** multiple disc clutch pack to provide the appropriate amount of torque to each axle in response to the operator's driving technique and operating surface conditions.

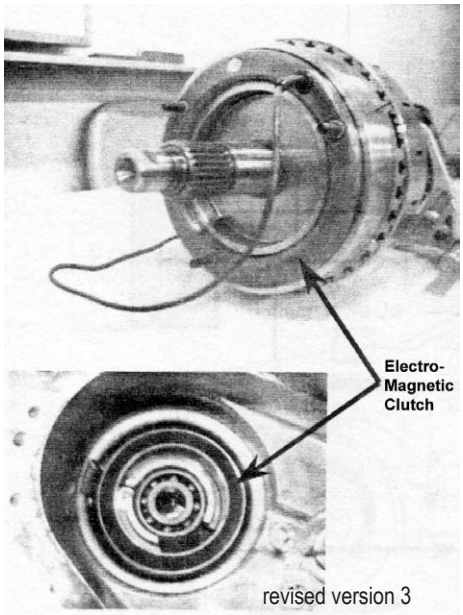
Using many vehicle sensor inputs, including front and rear output Hall effect speed sensors mounted in the TOD transfer case (unlike the EST, which only has a rear output sensor), the TCCM monitors the speed of each propeller shaft and the driving conditions. If no rapid speed increase is detected for the front or rear axle (without a corresponding speed increase for the other axle), the TCCM causes very little pressure to be applied to the TOD clutch pack and the drive ratio is maintained at approximately 100% torque to the rear axle and approximately 0% to the front axle.

The clutch piston is a ball ramp type of piston. As the driving end is rotated, it causes the driven end to also rotate and applies minimal drive to the clutch pack (even when not activated). When the magnetic clutch is activated by the ECM, the duty cycle application of the magnetic field seems to put a drag on the rotation of the driven end of the piston. As the driven end resists rotation, the driving end (relatively) shifts under the driven end causing the driving end to "walk" under the driven end and the ball ramp design causes the piston to "grow" longer. The wedge effect of the two halves of the piston causes the piston to apply pressure to the clutch pack to apply the clutch. In this manner, the clutch application pressure is achieved by using an inclined plane, rather than just a magnet (like an AC clutch. The duty cycle application of the magnet allows for almost infinite control of the drive to the front axle regardless of the road surface the vehicle is operated on.

When the TCCM detects a rapid speed increase at the rear axle without a corresponding speed increase for the front axle, the program of the TCCM interprets this as the rear wheels slipping and activates the magnetic clutch control to apply variable pressure to the TOD clutch pack in the transfer case. That causes a split in the delivery of drive torque to the axles that may achieve up to a 50/50 split of the available torque between the front and rear axles.



If the TCCM then detects a sudden increase in front axle speed without a corresponding increase in rear axle speed, the TCCM's program interprets this as the front wheels slipping and will reduce the application pressure on the TOD clutch pack in the transfer case to reduce the torque application for the front axle. The changes in application pressure to



the TOD clutch pack are accomplished by activating the magnetic clutch using a duty cycle, the shorter the duty cycle, the less application pressure in the clutch pack.

The TCCM monitors the operation of the TOD system continuously. The TCCM is mounted under the carpet on the passenger's side of the vehicle and communication with it to monitor operating parameters and DTCs may be gained using the High Scan Pro connected to either the 16-pin OBD2 connector under the instrument panel or the 20-pin diagnostic connector located in the engine compartment.

Similar to the Sorento part-time four-wheel-drive system, the TOD system also has a **4L** mode available when higher torque and lower speeds are preferred. Like the part-time system, the vehicle must be stopped, the transmission placed in N, and the selector switch moved to the **4L** position. During **4L** operation, there is no adjustable torque distribution in the TOD system and this mode should only be used on driving surfaces that will allow some slipping of the drive wheels to minimize tension buildup between drive axles which potentially could damage drivetrain components or cause vehicle instability.

The TOD system's advantage over the part time four-wheel-drive system or other competitive hydraulically activated full-time four-wheel-drive systems is the system's ability to constantly monitor the operation of both drive axles for slipping and the ability to electronically precisely adjust the amount of torque being delivered to each drive axle to an appropriate level. This enhances the Sorento's driving safety and stability regardless of rapid changes in the driving surface from dry, clean pavement, to mud, to ice or snow, to water covered. The driver never needs to worry about putting the vehicle into four-wheel-drive or taking the vehicle out of four-wheel-drive to minimize wear on powertrain parts or improve driving stability. The TOD system monitors vehicle operation and instantly makes any necessary drivetrain adjustments.

Fail-safe for "auto" mode is 0:100 power distribution for the front and rear axles. Fail-safe for "low" mode is 50:50 power distribution.

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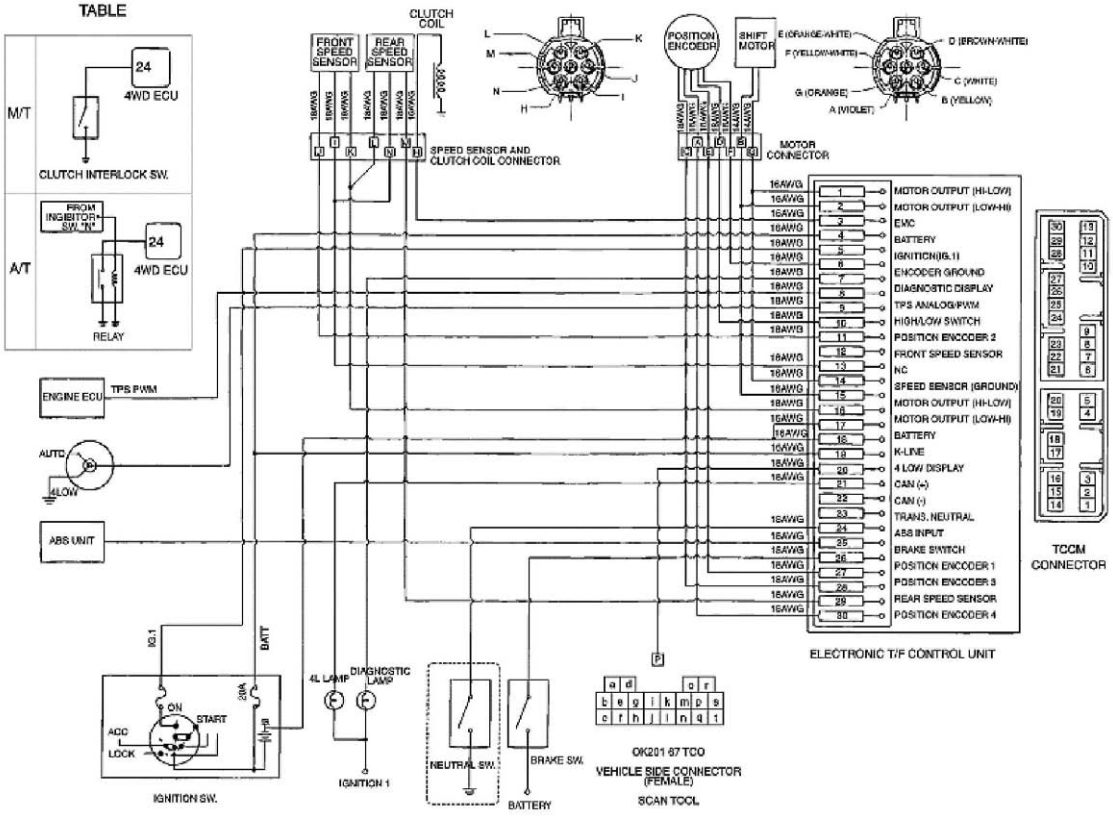


TOD Wiring Diagram

No.	DTC NO.	SENSOR OR SOLENOID	Σ3.5	
			Type	MIL
1	-	Vehicle speed signal from meter set	C	-
2	-	Brake SW malfunction	C	-
3	P0707	Inhibitor switch circuit low input	B	O
4	P0708	Inhibitor switch circuit high input	B	O
5	P0716	Input speed sensor circuit range/performance	B	O
6	P0717	Input speed sensor circuit no signal	B	O
7	P0722	Output speed sensor circuit no signal	B	O
8	P0726	Engine speed input sensor range/performance	C	-
9	P0727	Engine speed input sensor no signal	B	O
10	P0740	Torque converter clutch circuit malfunction	B	O
11	P0743	Torque converter clutch circuit electrical	B	O
12	P0748	Pressure solenoid electrical	A	O
13	P0750	Shift solenoid A malfunction	B	O
14	P0753	Shift solenoid A electrical	A	O
15	P0755	Shift solenoid B malfunction	B	O
16	P0758	Shift solenoid B electrical	A	O
17	P1115	Water temperature signal malfunction from ECU to TCU	C	-
18	P1121	Throttle sensor signal invalid	B	O
19	P1630	CAN communication BUS OFF	B	O
20	P1631	No ID from ECU	B	O
21	P1795	Transfer high/low switch malfunction (Only for 4WD)	B	O
22	P0710	Transmission fluid temperature sensor circuit malfunction	B	O
23	P0604	Internal control module random access memory error	-	-
24	P0601	Internal control module memory checksum error	-	-

Fault type

- TYPE A: DTC stored on the 1st driving
- TYPE B: DTC stored on the 2nd driving
- TYPE C: only fail-safe (Not DTC stored)

Warning lamp (W/L): O/D OFF lamp

MIL/Warning:

"O" - Supported (To be performed at the same time as DTC store)

"-" - Not supported

No.	Description	P-Code	Failure Effect	Fail-Safe	W/Lamp
1	EEPROM checks UM fault	P1725	TOD	Default calibration data	—
2	TPS loss of signal	P1726	TOD (TPS idle)	TOD determined by wheel slip only	OFF
3	TPS out of range	P1727	TOD (TPS idle)	TOD determined by wheel slip only	OFF
4	EMC open/shorted to battery	P1728	TOD halted (2WD)	None	Blink
5	EMC shorted to ground	P1729	TOD halted (2WD)	None	Blink
6	Front speed sensor voltage low	P1730	TOD	4H mode fail. Rear speed sensor. EMC Touch off level fixing 4L Mode fail. EMC Maximum level fixing	OFF
7	Front speed sensor voltage high	P1731	TOD		OFF
8	Rear speed sensor voltage low	P1732	TOD	4H mode fail. Front speed sensor. EMC Touch off level fixing 4L Mode fail. EMC Maximum level fixing	OFF
9	rear speed sensor voltage high	P1733	TOD		OFF
10	Vehicle speed sensor reference voltage low	P1734	TOD	4H mode fail. Zero speed sensor. EMC Touch off level fixing 4L Mode fail. EMC Maximum level fixing	OFF
11	Vehicle speed sensor reference voltage high	P1735	TOD		OFF
12	Shift motor open/shorted to battery	P1736	Electric motor shifting (4H-4L-4H)	No shifts	Blink
13	Shift motor open/shorted to ground	P1737	Electric motor shifting (4H-4L-4H)	No shifts	Blink
14	Shift system timeout	P1738	Electric motor shifting (4H-4L-4H)	No shifts	Blink
15	General position encoder fault	P1739	Electric motor shifting (4H-4L-4H)	No shifts	OFF
16	Position 1 shorted to ground	P1740	Electric motor shifting (4H-4L-4H)	No shifts	OFF
17	Position 2 shorted to ground		Electric motor shifting (4H-4L-4H)	No shifts	
18	Position 3 shorted to ground		Electric motor shifting (4H-4L-4H)	No shifts	
19	Position 4 shorted to ground		Electric motor shifting (4H-4L-4H)	No shifts	

Engine Over-run Inhibition Control

In case a driver turns the OD OFF switch on or changes a shift lever to the "2L" range while driving in 4th gear in "D" range at high speed, the TCM will not shift down until the vehicle speed is reduced. This will prevent the engine from over-revving.

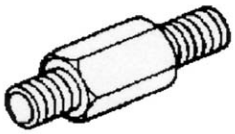
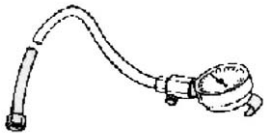
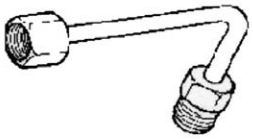
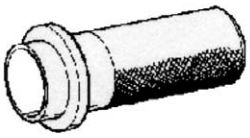
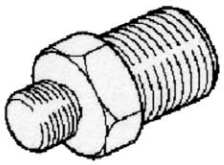
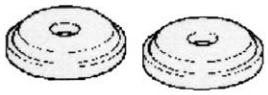
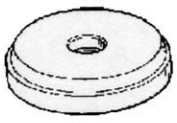
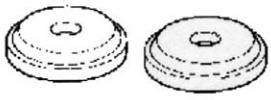
DTC Detected Condition and Fail-Safe (Subject to change.)

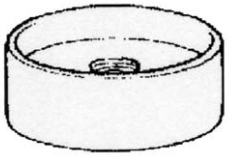
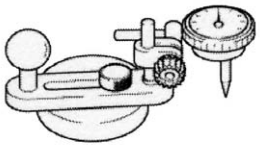
Code	Description	Fail-Safe
P0707	Output speed >= 1130, Engine RPM >= 1500	Judge D range (system mechanically operates)
P0708	2 or more signals are detected for more than 10 sec.	D>2>L>R>N>P (operation priority)
P0722	(1st - 3rd gear) No output while 45 input pulses detected (4th gear) 1500 output RPM drop and 0 RPM detected	Gear shift by using input speed sensor signals
		No lock-up/4th fear/ETR/LPC/Reverse/Squat control
P0743	(Short to GND) OFF detected for 300 msec after ON (Open/short to B+) ON detected for 50 msec after OFF	DCCSV OFF
		1st gear hold if output RPM <375 (Open/B+ short)
P0748	(Open/short to GND) AD value =< 15 for 70 msec (Short to B+) AD value >= 1000 for 500 msec	4th Gear hold
P0753	(Short to GND) OFF detected for 300 msec after ON (Open/short to B+) ON detected for 50 msec after OFF	Lock-up inhibited Gear hold: D range - 4th, 2 range - 3rd, L range - 1st
P0758	(Short to GND) OFF detected for 300 msec after ON (Open/short to B+) ON detected for 50 msec after OFF	Lock-up inhibited Gear hold: D range - 4th, 2 range, 3 rd, L range - 1st
P1121	TPS message FF H is received for 0.2 sec.	Judge TPS 0%, Max line pressure, No ETR/LPC
P0710	(Short) Abnormal sensor resistance detected for 5 min. (Open) AD value is under 15 or over 1000 detected	Judge ATF temp. 200˚C, No lock-up, ETR/LPC inhibited while shifting
P1115	WT message FF H is received for 0.2 sec.	Judge the temp. normal
P0717	No input while 12 pulses of output signal are detected	No lock-up ETR/LPC inhibited while shifting
P0716	Input speed >= 7000 RPM detected	—
P1630	BUS OFF is detected 0.2 sec after IG on	No lock-up, maximum line pressure, No ETR/LPC
P1631	No message received from ECM	No lock-up, maximum line pressure, No ETR/LPC
—	Output RPM >= 2260, TPS >= 5%, Brake on >= 10 sec.	Ignore the brake signal, Lock-up available

DTC List (Subject to change.)

DTC	Description	3.5 V6	
		Fault Type	MIL.
P0707	Transmission Range Sensor Circuit Low Input	B	O
P0708	Transmission Range Sensor Circuit High Input	B	O
P0722	Output Speed Sensor Circuit No Signal	B	O
P0726	Engine Speed Input Sensor Range/Performance	B	O
P0727	Engine Speed signal invalid	B	O
P0740	Torque Converter Clutch Circuit (SL) Malfunction	B	O
P0743	Torque Converter Clutch Circuit (SL) Electrical	B	O
P0750	Shift Solenoid A (S1) Malfunction	B	O
P0753	Shift Solenoid A (S1) Electrical	A	O
P0755	Shift Solenoid B (S2) Malfunction	B	O
P0758	Shift Solenoid B (S2) Electrical	A	O
P0748	Pressure Solenoid (SLT) Electrical	A	O
P1121	Throttle Sensor Signal invalid	B	O
P0710	ATF Temp. Sensor Circuit Malfunction	B	O
P1115	Water Temp. Signal Malfunction from ECU to TCU	B	O
P0717	Input Speed Sensor Circuit No Signal	B	O
P0716	Input Speed Sensor Circuit Range/Performance	B	O
P1795	Transfer High/Low (L4) Switch Malfunction	B	O
P1630	CAN communication BUS OFF	B	O
P1631	NO ID from ECU	B	O
—	Vehicle Speed Signal from meter set	C	—
—	Brake SW malfunction	C	—

*** Fault Type—Type A: DTC stored on the 1st driving, Type B: DTC stored on the 2nd driving, Type C: only failsafe (not DTC stored)**
***Warning lamp: O/D OFF lamp**

S/N	Group	Type	Tool Number/Name	Illustration	Unique	Remark
37	TRA—Auto. Trans.	03-40LEi	09452-21000 Oil pressure gauge adapter			use with: 09452-21500 09452-21600 09452-32300
38	TRA—Auto. Trans.	03-40LEi	09452-21500 Oil pressure gauge			use with: 09452-21600 09452-21000 09452-32300
39	TRA—Auto. Trans.	03-40LEi	09452-21600 Oil pressure gauge adapter			use with: 09452-21500 09452-21000 09452-32300
40	TRA—Auto. Trans.	03-40LEi	09452-32100 Oil seal installer			
41	TRA—Auto. Trans.	03-40LEi	09452-32300 Oil pressure gauge adapter			use with: 09452-21000 09452-21500 09452-21600
15	DS—Driveline Systems		09432-33700 Bearing outer race installer			use with: 09500-21000
19	DS—Driveline Systems		09517-21000 Oil seal installer			use with: 09500-21000
23	DS—Driveline Systems		09532-32000 Oil seal installer			use with: 09500-21000

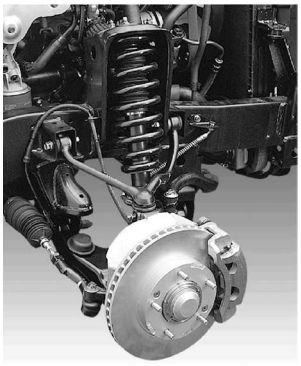
S/N	Group	Type	Tool Number/Name	Illustration	Unique	Remark
24	DS—Driveline Systems		09542-4A000 Oil seal installer			use with: 09500-11000
26	DS—Driveline Systems		09532-31200B Oil seal installer			use with: 09500-21000
30	DS—Driveline Systems		OK993 270 A09 Drive pinion			use with: OK993 270 A08 OK993 270 A10
31	DS—Driveline Systems		09530-FM000 Limited slip differential test adapter		O	

Section 6 • Brakes–Non-ABS

General Information

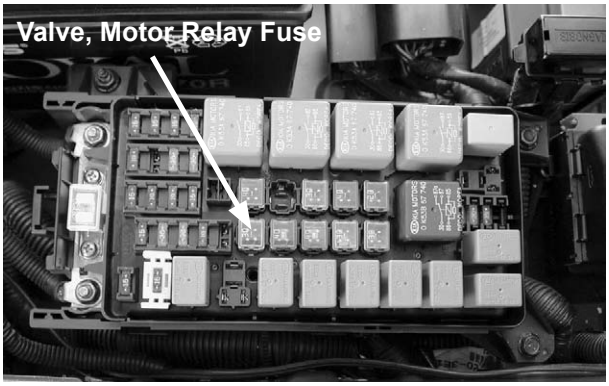
The 2003 Sorento feature four-wheel disc brakes which receive fluid pressure from a diagonally-split brake line configuration. The brakes for both front and rear use floating calipers with vented discs. The brake calipers in the front are dual-piston, while the rear calipers are single piston. The ventilated discs outer diameter at the front measure 11.8 inches and the rear discs measure 12.4 inches.

Standard brake bleeding procedure is appropriate (consult the Sorento Service Manual).



Anti-Lock Brake System (ABS)

The 2003 Sorento is optionally equipped with the **Bosch 5.3 Anti-Lock Brake System (ABS)**. This is a four-sensor, four-channel, diagonally split brake line ABS system with EBD Control. The Hydro-Electric Control Unit uses a 180-watt motor, solenoids for Inlet/Outlet Control, and an ECU attached to the body. Since the Bosch ABS system uses four wheel speed sensors, the waveforms for all four sensors must be identical (check gap at 0.3 - 1.2mm), otherwise, the ABS will detect wheel slip.



ECU	Operating voltage	8~16V	
	Operating temperature	-40˚F ~ 248˚F	
	Reverse voltage	13.5V	
HECU (HU+ECU)	Weight	2.7Kg	
	Pump capacity	4.8 cc/sec	
	Power consumption	230W	
Solenoid Valve	Resistance	Inlet Valve (EV): 8.54Ω ± 0.5Ω	
		Outlet Valve (AV): 4.29Ω ± 0.25Ω	
Return Pump Motor	Operating current	45A or less	Pump Motor
	Maximum current	45A or less	
Wheel Speed Sensor	Coil resistance	1600Ω ± 10%	- Air Gap Front: 0.3~1.2mm Rear: 0.3~1.2mm
	Insulation resistance	1MΩ	
	Tone wheel	48 EA	

Please consult your Service Manual for ABS service procedures.

Install location

Anti-Lock Brake System (ABS)

Acceleration Sensor

The four wheels of an AWD (all Wheel Drive)/ 4WD vehicle are linked by the center differential, so the engine braking force acts on all the wheels. In the event one of the tires of an AWD vehicle begins to slip, the torque of the tire that is beginning to slip is distributed to the other tires, making the rotation speed of all the tires virtually identical. Since the signals being sent to the ABSCM from the four ABS sensors at this time are similar, the reference vehicle speed calculated by the ABSCM is less than the actual vehicle speed. Using the calculated vehicle speed and acceleration as a basis for ABS control would result in error that would increase the danger of wheel slip.

In order to overcome the problem described above, an AWD vehicle is equipped with an **acceleration sensor (G-sensor),** located under the center console, which is used to determine the actual deceleration of the vehicle.

For example, if a driver slams the brake pedal on ice making all wheels lock-up, the vehicle begins to slide and the G value (deceleration) is low. This is because all the wheels lose their grip on the ice and they cannot achieve the desired frictional force which would increase the G value.

Therefore the G-sensor allows the ABSCM to recognize all wheel slip tendencies by measuring the low G value.

Even if all wheel speeds are reduced because of one or two wheels locking-up, if the G sensor value remains high, ABSCM corrects the reference vehicle speed that comes from only the locked wheel.

Accelerator Sensor

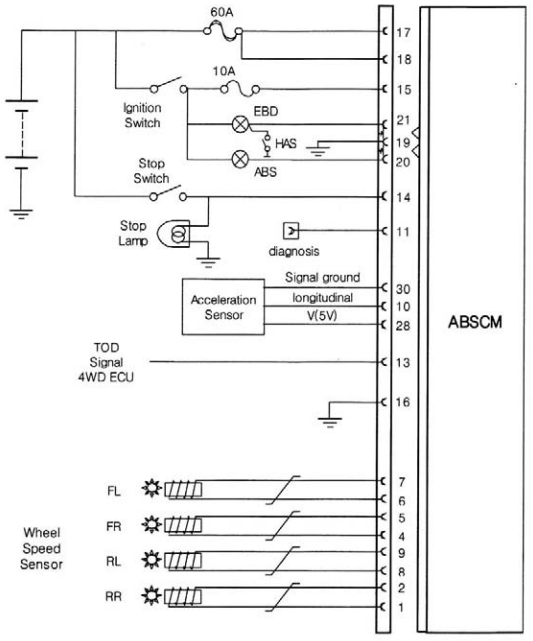
Normal Operation

In normal conditions, equal brake pressure is delivered from the master cylinder to each caliper via an **inlet valve** which is normally an open type.

Unless the ABS mode has been actuated, the pump motor does not operate.

The purpose of the **accumulators** is to save brake fluid for a constant fluid supply to the pump during pump operation in ABS mode. During EBD operation when the pump does not run, the accumulator stores fluid which comes from the outlet valve.

The purpose of **dampers** is to absorb pressure fluctuation and noise while the pump motor operates.



External Wiring Diagram

DTC	Description	W/L	Check Point
C0800	High voltage (over 16V)	O	Battery voltage, wire, fuse
C0800	Low voltage (8V or less)	O	Battery voltage, wire, fuse
C0035	WSS FL - continuity	O	WSS, connector, wire harness
C0035	WSS FL - plausibility	O	Wire check, short, air gap, tooth
C0040	WSS FR - continuity	O	WSS, connector, wire harness
C0040	WSS FR - plausibility	O	Wire check, short, air gap, tooth
C0045	WSS RL - continuity	O	WSS, connector, wire harness
C0045	WSS RL - plausibility	O	Wire check, short, air gap, tooth
C0050	WSS RR - continuity	O	WSS, connector, wire harness
C0050	WSS RR - plausibility	O	Wire check, short, air gap, tooth
C0930	Acceleration sensor	O	Connector, sensor failure, wire open
C0060	Solenoid Valve - LF (AV)	O	Short, MV line open
C0065	Solenoid Valve - LF (EV)	O	Short, MV line open
C0070	Solenoid Valve - RF (AV)	O	Short, MV line open
C0075	Solenoid Valve - RF (EV)	O	Short, MV line open
C0080	Solenoid Valve - RL (AV)	O	Short, MV line open
C0085	Solenoid Valve - RL (EV)	O	Short, MV line open
C0090	Solenoid Valve - RR (AV)	O	Short, MV line open
C0095	Solenoid Valve - RR (EV)	O	Short, MV line open
C0110	Motor pump	O	Motor or relay circuit failure
C0121	Valve relay	O	Valve relay failure
C0161	Brake switch	X	Switch failure, brake lamp
C0245	WSS frequency error	O	Poor tooth gear or damage
C0550	ECU malfunction	O	ECU failure

ABS & EBD Warning Lamps

EBD & Parking Brake Lamp

ABS Warning Lamp

- ECU failure
- Solenoid valve failure
- Parking brake
- Low brake oil
- Short G bar failure
- Acceleration sensor

- Wheels sensor failure (open or short)
- Low/high voltage
- While diagnosis
- Short G Bar Failure
- Acceleration sensor

Electronic Brake Distribution (EBD)

The **Electronic Brake force Distribution** (EBD) system is a sub-system of the ABS system and controls the effective adhesion by the rear wheels.

It further utilizes the efficiency of highly developed ABS equipment by controlling the slip of the rear wheels in the partial braking range. The brake balance, which is controlled electronically, is moved even closer to the optimum, eliminating the need for the proportioning valve.

A typical proportioning valve, because it's a mechanical device, is limited in its ability to achieve an ideal brake balance under varying conditions of vehicle weight and weight distribution. Also, a malfunction of a proportioning valve manifests itself only by its failure to prevent rear wheel lock-up.

The EBD is controlled by the ABS Control Module, which continuously calculates the slip ratio of each wheel and controls the brake pressure at the rear wheels to assure a greater adhesion coefficient at the front wheels.

If the EBD fails, the EBD warning lamp (parking brake lamp) is illuminated.

EBD Modulation

Range 1: Hold Mode

Rear pressure "hold," when the rear slip tendency is higher than the front wheel.

Range 2: Increase Mode

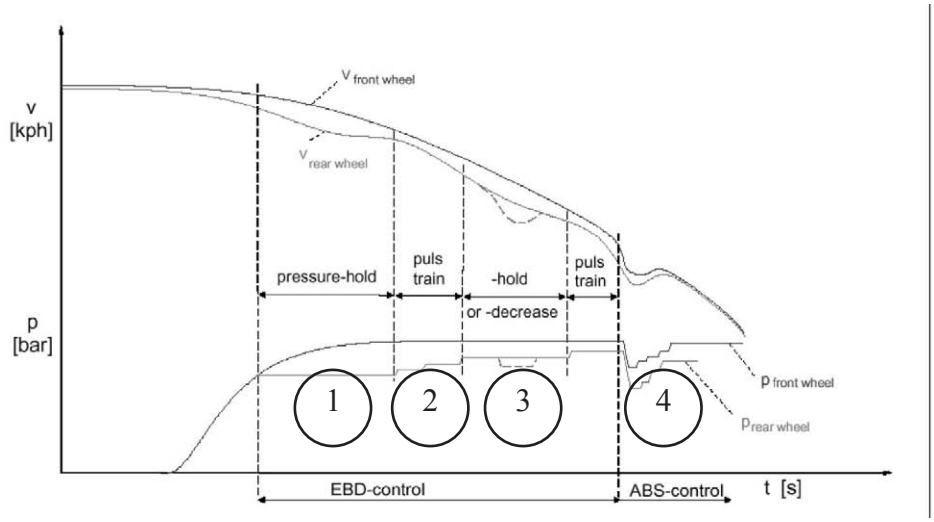
Rear pressure "increase," when rear wheel speed recovers to get a brake force.

Range 3: Decrease Mode

Rear pressure "decrease," when rear wheel slip increase after "hold mode"

Range 4: Out of EBD Control

EBD control is finish. ABS control of rear and front wheels begins.



Failure Matrix

ABS disabled, EBD enabled (Failsafe function)
ABS and EBD disabled
ABS and EBD enabled
X not possible

Failsafe function that always leads to keep alive function / second failure		Power-supply *1)			WSS					BLS	PM	MR	VR		G-Switch
		low voltage 9,4V > Uz > 6,9V	low voltage <6,9 V <- reversibl *1) thresholds hard-	over-voltage >17,4 V ware depended	WSS-failure ohm	WSS-failure non-ohm (FDFP)	WSS-failure high-frequency <- reversible	WSS-failure low-frequency (FFZ	2 WSS-failures	BLS-Failure	failure	failure	sticking	interruption	sensor failure
Power-supply	reversible -> low voltage 9,4V > Uz >	X	X	X											
WSS	wheel speed sensc ohm														
	non-ohm (FDFP)														
	2 WSS-failures														
	reversible -> high-frequenzy														
BLS	brake light switch									X					
PM	pump motor failure										X	X			
MR	motor relay failure										X	X			
VR	ventil relay sticking												X	X	
G-Switch	sensor failure														X

Steering

The 2003 Sorento is equipped with an **Engine RPM Sensing** power-assisted rack and pinion steering system. **Vehicle Speed Sensing** power steering is also available (EPS found on EX trim levels only). In the case of the RPM sensitive system, the power steering gear and control is a one piece unit (very similar to the system installed on the Sedona). The turning radius is 36.4 feet.

Operations Shared by Both Systems

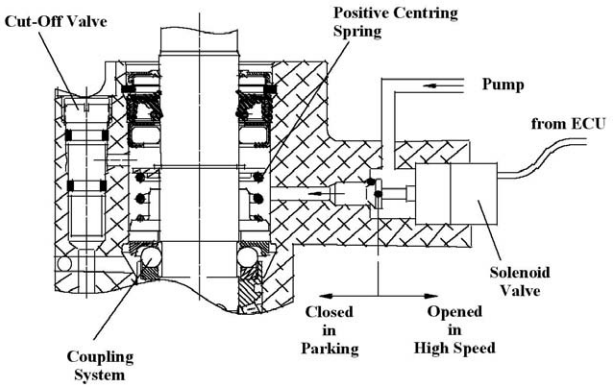
The **power steering pump**, driven by the crank shaft pulley through a drive belt develops the system's hydraulic pressure which is converted into mechanical force through the rack and pinion steering gear to turn the wheels.

The power steering pump is a vane-type pump that draws fluid from the power steering reservoir when the engine is running.

Fluid type: PSF-III.

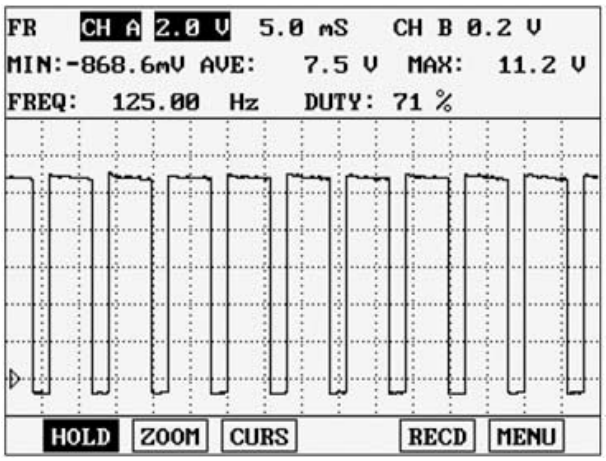
EPS—Electronic Power Steering

An **Electronic Power Steering Control Module** analyzes the signal from the VSS and varies the amount of fluid passing through the steering rack by varying the amount of current applied to a solenoid valve through the use of a duty-cycled signal. As vehicle speed increases, the percentage of duty cycle is lowered, reducing current flow through the solenoid and increasing steering effort.



EPS—Condition in Parking and Very Low Speed

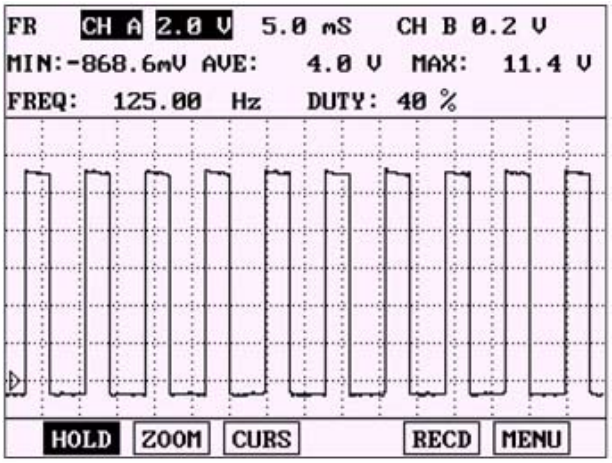
The solenoid valve is fully energized (1 amp of current, 71% duty cycle) and closes the gallery from pump supply to the reaction chamber. Because of the relief orifice in the cut-off valve, the pressure in the reaction chamber is always on return pressure level. Therefore the steering wheel torque is determined only by the torsion bar plus the centering spring characteristic.



Signal at solenoid pin 2 @ 0 MPH

EPS—Condition at Low/Medium Speeds: (speeds up to 62 MPH)

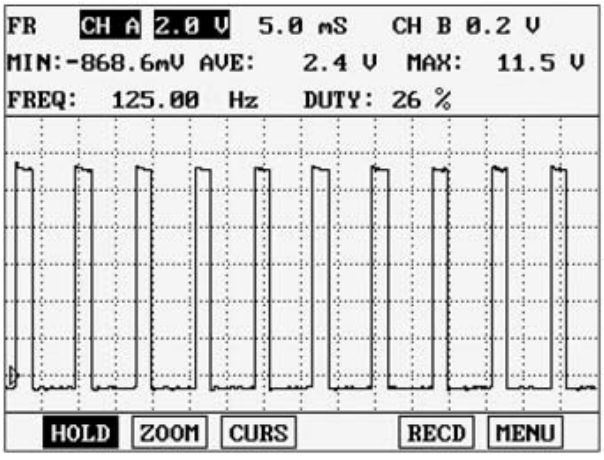
The solenoid is opened partially and therefore when activating the valve, the reaction pressure in the reaction chamber will increase and create reaction torque which is working against the valve deflection. Linear behavior of pressure vs. torque gives precise steering while cornering at medium speed driving.



Signal at solenoid pin 2 @ 50 MPH; solenoid current flow at this speed will be around .6A.

EPS—Condition at High Speed: (75 MPH and above)

The solenoid is completely opened and the reaction pressure is determined by the balance of the orifices of solenoid valve and cut-off valve. Therefore the steering wheel torque is controlled primarily by the amount of hydraulic reaction which gives the characteristic linear torque vs. pressure behavior. This linear behavior provides excellent steering response comparable to manual steering gears but with controllable steering effort level. Above a certain torque which is determined by the reaction pressure, the cut-off valve opens and restricts further torque increase. Then full hydraulic support is available in case of evasive maneuvers and wheel bursts.



Signal at solenoid pin 2 @ 75 MPH; solenoid current flow will be about .4A at this speed.

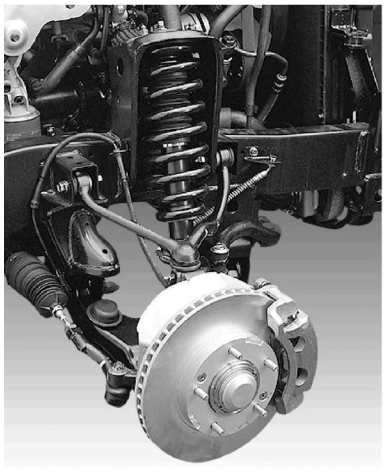
Fail-Safe Functions

Provisions have been made for fail-safe capability during certain circumstances. VSS failure will cause the EPSCM to allow maximum current (1A) to flow at all speeds; the result will be consistent light steering effort. Solenoid signal failure will have the opposite effect; an interruption in solenoid current will result in heavy steering effort at all speeds.

Suspension

Front Suspension

The 2003 Sorento uses a double wishbone and coil-over front suspension with a sway bar. The upper ball joint is integral while the lower ball joint can be serviced separately. Camber and caster are adjustable through eccentrics incorporated in the frame mounting locations of the lower control arms. The toe adjustment is facilitated by threaded tie rod ends.



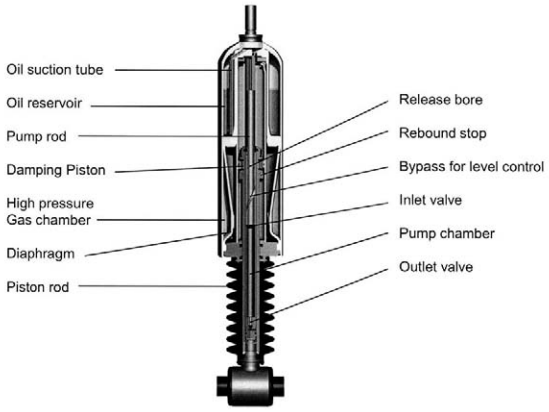
Rear Suspension

The rear suspension consists of a rear differential axle with coil springs and shock absorbers, attached to the frame by a five-link type system. A sway bar is used to minimize body roll. Rear alignment is not adjustable.

Self-Levelizer

Self-leveling shock absorbers are available as an option on the EX trim level. When additional load is added to the vehicle, a pumping action is created from the relative movement between the axle and the vehicle body. This pumping action results in an increase in vehicle height due to the build-up of high-pressure oil within the shock assembly. As load is reduced, the vehicle height will momentarily increase, a release device operates, high-pressure oil is released, and the vehicle height will decrease.

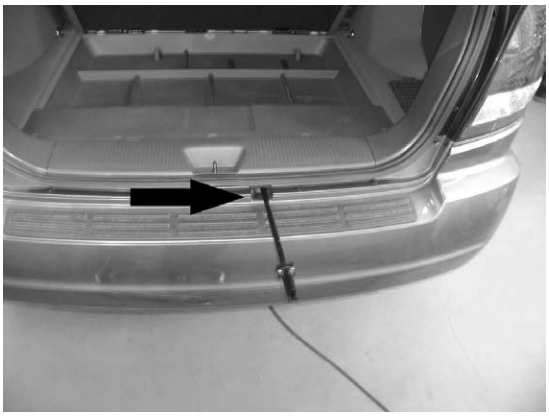
The self-levelizer system is not dependent on external sensors or pump assemblies.

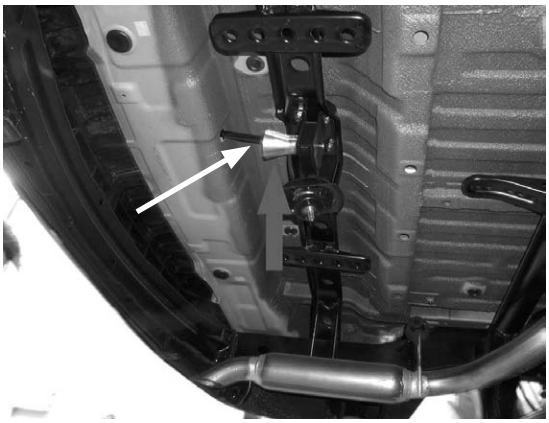


Wheels and Tires

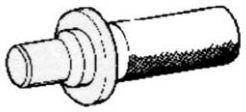
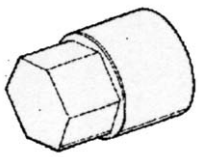
The 2003 Sorento is equipped with P245/70R16 tires. Steel wheels are standard on the LX; aluminum wheels are standard on the EX (aluminum wheels are optional on the LX).

The spare tire is a full-size unit mounted beneath the rear of the vehicle. A cable-operated winch assembly is fitted to facilitate spare tire removal/installation.





Special Service Tools

S/N	Group	Tool Number/Name	Illustration
75	SST—Steering and Suspension	09431-11000 Front oil seal installer	
76	SST—Steering and Suspension	09432-21601 Bearing installer	
80	SST—Steering and Suspension	09565-31300 Yoke plug wrench socket	

Section 8 • Body

Overview

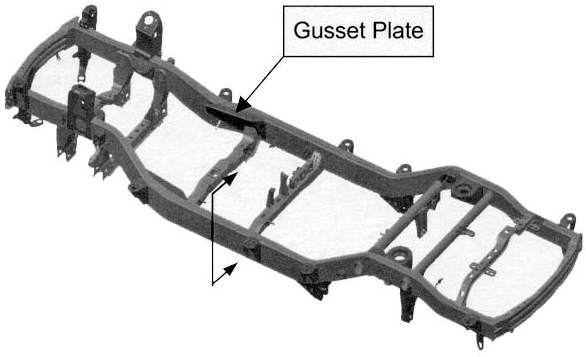
The 2003 Sorento's body has a powerful and prestigious look, featuring a body-on-frame construction with nine cross members. A gusset plate has been added for additional rigidity.

The front view of 2003 Sorento is wide and aggressive featuring a large size radiator grill.

The 2003 Sorento has a wheel base of 106.7 inches. There is plenty of room for cargo inside and an optional roof rack available.

The tailgate has a flip open type glass that is controlled from the driver's door panel switch. The rear wiper is computer-controlled to prevent wiper operation when the glass is opened.

The spare tire is located under the rear cargo area of the vehicle. It is lowered using the handle that is located under the cargo area panel. The jack is located behind the trim panel on the passenger side of the rear cargo area. The rear washer bottle shares the front water bottle located under the hood.

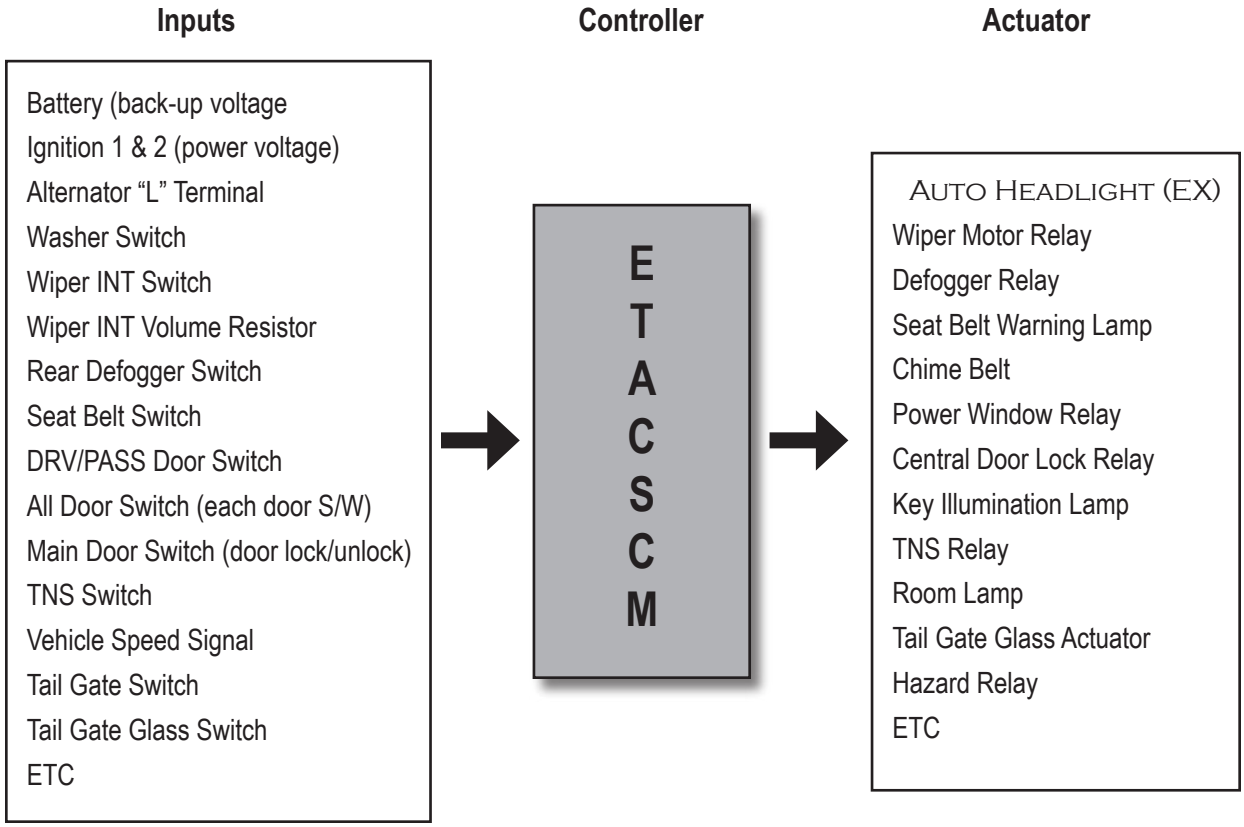


Electronic Time & Alarm Control System (ETACS)

The **Electronic Time and Alarm Control System (ETACS)** directs the operation of various body electrical functions.

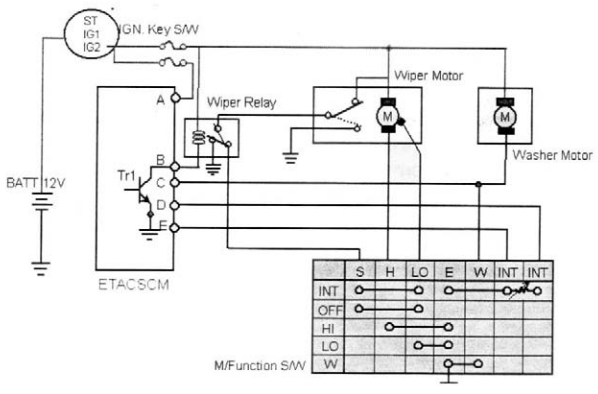
Availability of features varies with vehicle trim level.

ETACS Input & Output Diagram



Front Wiper/ Washer Control

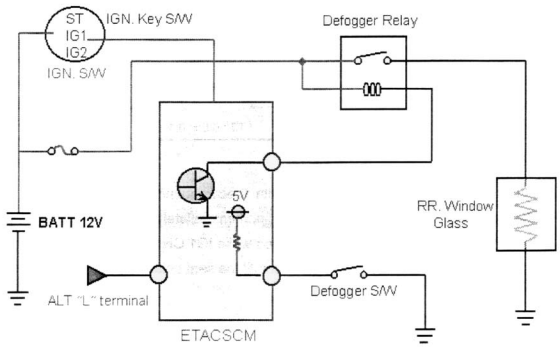
The multifunction switch serves as an input to the ETACS. Front wiper and washer motor operation is controlled by the ETACS module.



Washer & Wiper Circuit

Rear Window Defogger Timer

The rear defogger timer provides for 20 minutes of rear defogger operation once the switch is pressed. Due to the current consumption of the heater grid (15-20A), the defogger should only operate while the engine is running. To facilitate this, the ETACS receives input from the "L" terminal of the generator. If the generator is not charging, the signal will be low (around 2.5v). Under this condition, the rear defogger will not operate. Once the "L" terminal signal goes high (around 12V), the ETACS will then allow the rear defogger to operate.



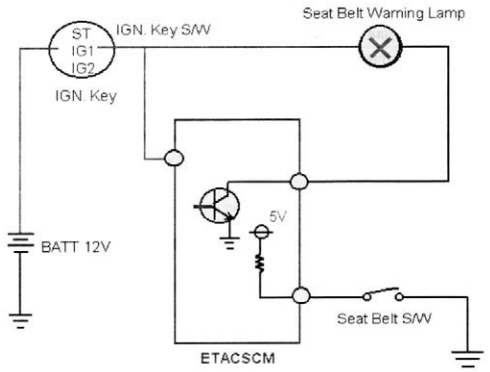
Defogger System Circuit

Heated Outside Mirrors

The heated outside mirrors have the same operating parameters as the rear defogger.

Seat Belt Warning

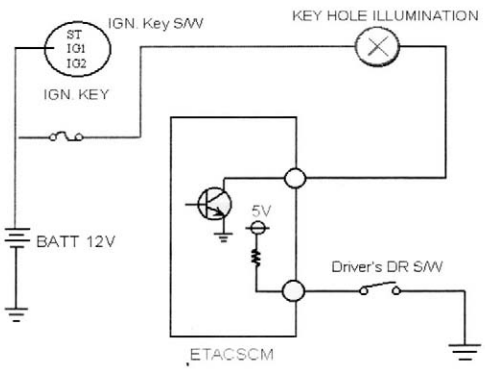
The ETACS controls **Seat Belt Warning Lamp** and chime operation based on input from the driver's seat belt switch. The chime will sounds if the seat belt is not connected while starting the engine and if the seat belt is disconnected while the engine is running.



Seat Belt Warning Circuit

Ignition Switch Illumination

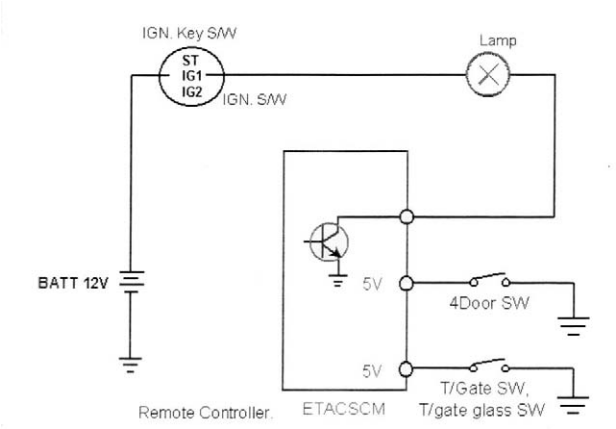
The **Ignition Switch** will illuminate with the key OFF for a period of 10 seconds (+/- 1 second) when the driver or front passenger door is opened.



Keyhole Illumination Circuit

Interior Lights Delay Out Circuit

The interior lights will immediately reduce to 75% brightness once all doors are closed. The lighting will then fade out within a 5-6 second time period.



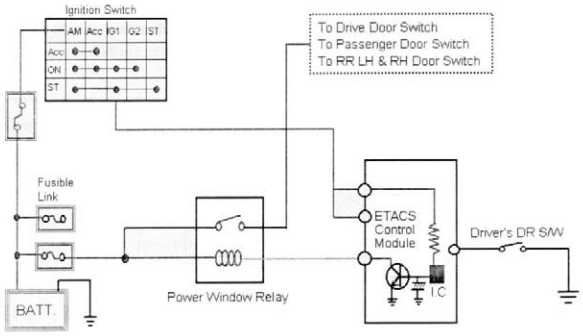
Interior Light Delay Out Circuit

2-Turn Unlock Feature

Turning the key in the driver door lock cylinder to the UNLOCK position will unlock the driver door only. All doors will unlock if the key is turned to the UNLOCK position a second time within three seconds. Turning the key to the LOCK position will lock all doors.

Power Window Timer

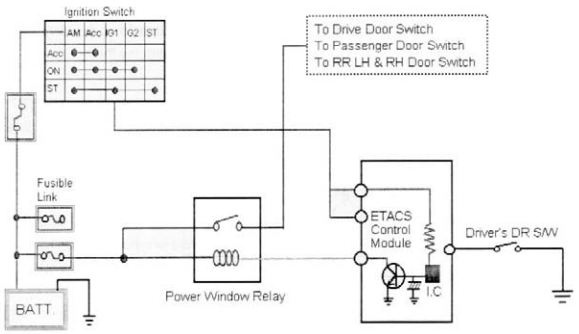
Power window operation is possible for 30 seconds after the ignition switch is placed in the OFF or LOCK position providing the driver/front passenger door remains closed.



Power Window Timer Circuit

Ignition Key Reminder/ Lock-out Protection

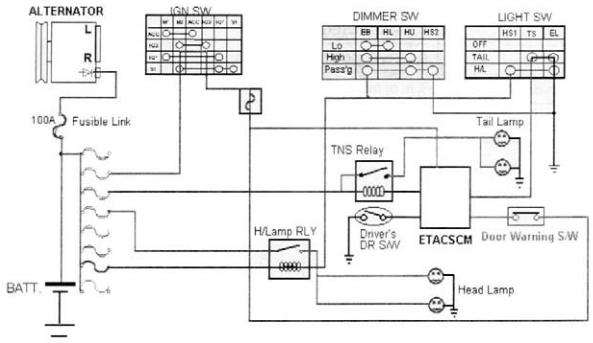
In addition to the audible warning produced with the key in the ignition cylinder and the driver door in the open position, the door locks will automatically cycle to the UNLOCK position if an attempt is made to lock the doors with the key in the ignition. However, the doors can be manually locked which will cancel the lock-out protection feature.



Ignition Key Reminder/ Lock-out Protection Circuit

Battery Saver Function

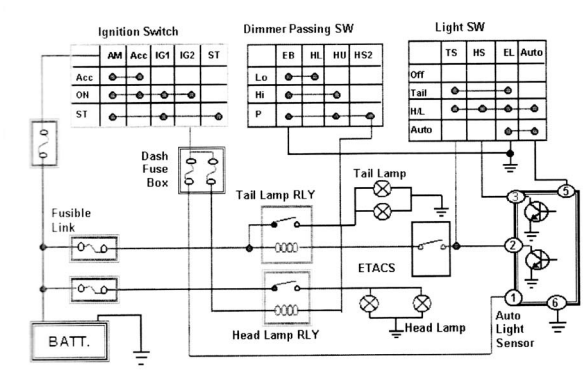
The headlights will shut down once the ignition switch is turned OFF. Parking lamps will remain illuminated until the key is removed and the driver door is opened; at that point all exterior lamps will be extinguished.



Battery Saver Function Circuit

Auto Light Function

An **Auto Light Sensor**, which is only available on the EX Luxury package, detects the available light level and facilitates automatic activation of the exterior lamps. There is a 500ms delay prior to lamp illumination; a three-second delay exists within the OFF function logic.



Auto Light Function Circuit

Remote Keyless Entry

The 2003 Sorento **Remote Keyless Entry System**, which comes standard on the EX, permits operation of the door lock/unlock functions from a distance of up to 16 feet from the vehicle. The unlock function on the RKE operates the same as the Two-Turn Unlock feature accessible from the driver door key cylinder; interior illumination is also activated when the doors are unlocked.

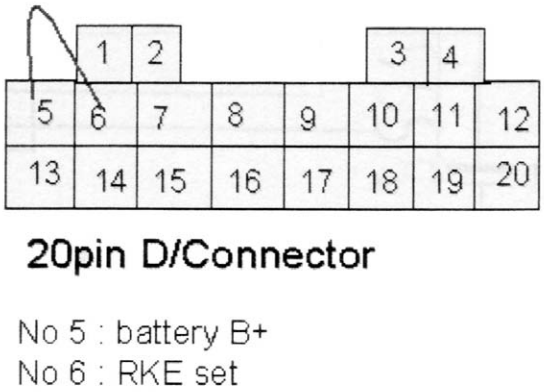
A panic function is incorporated as part of the RKE circuitry. Pressing the panic button on the transmitter for 2.7 seconds or more will result in hazard lamp and horn activation for 27 seconds. The panic function can be cancelled by pressing the UNLOCK button on the transmitter (pressing the panic button for 2.7 seconds or more will also cancel this function).

RKE Transmitter Programming

The 2003 Sorento RKE system will accommodate a maximum of two transmitters.

Programming Procedure (single transmitter)

1) Insert the ignition key and turn the switch to the ON position.
2) Install a jumper wire between pins 5 and 6 of the 20 pin under-hood DLC.



3) Press the LOCK button on the transmitter until the turn signal lamps are extinguished (lamps will blink twice).
4) Release the LOCK button, remove the jumper wire, and turn the ignition key to the OFF position.

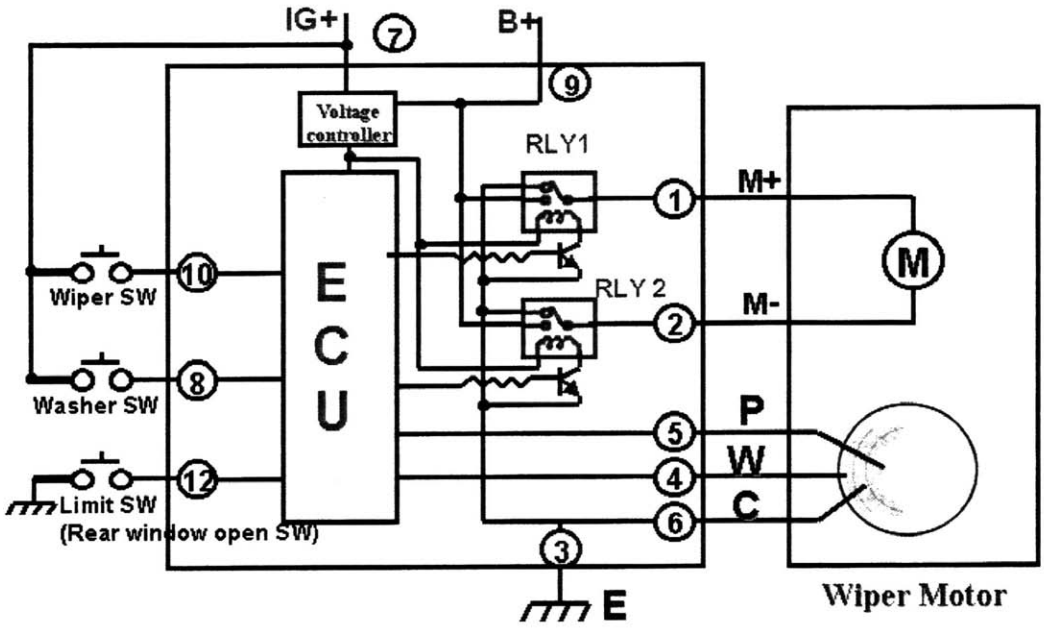
Programming Procedure (two transmitters)

1) Insert the ignition key and turn the switch to the ON position.
2) Install a jumper wire between pins 5 and 6 of the 20 pin under-hood DLC.
3) Press the LOCK button on the first transmitter for 1 second (turn signals will blink once).
4) Press the LOCK button on the second transmitter for 1 second (turn signals will blink once again).
5) Remove the jumper wire, turn the ignition switch OFF, and remove the key.

Rear Wiper System

The rear wiper functions are separate from the ETACS. An ECU for rear wiper functions is located in the tailgate. The rear wiper system features ON, intermittent, and momentary activation. The rear washer obtains fluid from the front reservoir.

The 2003 Sorento rear tailgate glass can be opened independently from the rear tailgate; functionality is incorporated into the rear wiper ECU to automatically park the rear wiper if the rear tailgate glass is opened. To restore normal operation, the rear wiper switch must be cycled from OFF to ON should the rear tailgate glass be opened with the rear wiper switch ON.

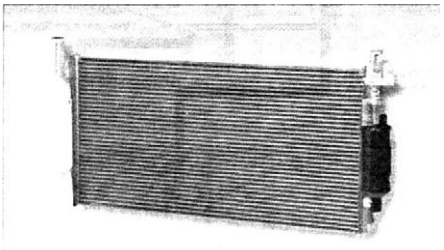


Rear Wiper System Circuit

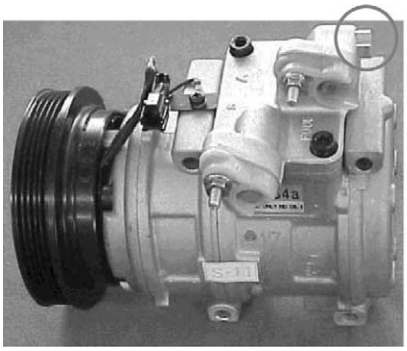
Full Auto Temperature Control (FATC)

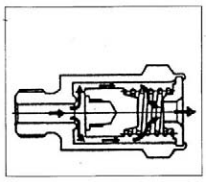
The 2003 Sorento is available with a manual or an optional **Full Auto Temperature Control (FATC)** system. Both systems use R-134a, and are of the expansion valve/receiver-dryer type (as are all Kia A/C systems). A swash plate type compressor is fitted, and a parallel flow condenser is employed.

- The R-134a capacity: 1.32 pounds.
- Compressor oil capacity: 5.29 ounces.

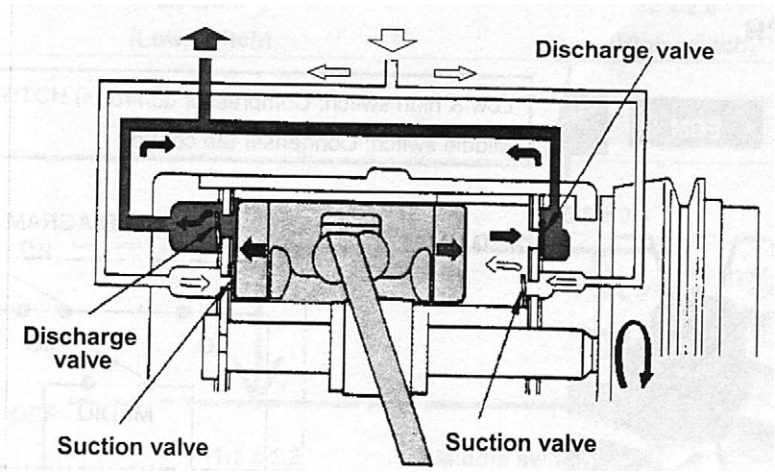


R-134A, parallel flow type condenser





(above and right) Compressor



The ECM controls the **compressor clutch** operation. Once an A/C request is received, the ECM will then signal the A/C relay if all conditions are correct. Cooling/Condenser fan speeds and ISC position are also managed by the ECM based on A/C system operation.

Manual Body Electrical

A single climate control panel is fitted on vehicles with the manual system. The knob on the left controls the blower (4-speed). The center knob is for mode selection; a button in the center of the knob controls fresh air/recirculation mode operation. The knob on the right is used to adjust discharge air temperature, and incorporates a button for A/C compressor operation requests.

Note*: Cable controls are not used in the 2003 Sorento.*

Manual air conditioner

Full Auto Temperature Control (FATC)

The optional FATC system features completely automatic control over discharge air temperature, mode door operation, blower speed, and A/C compressor operation. A variety of sensors feed data to a central control panel. Circuitry within the control panel in turn manages blower speed, temperature (mix) door position, mode door position, intake actuator (fresh air/recirc), and A/C compressor request signals to the ECM.

FATC without AQS

To change from metric to standard, hold the AMB and Down TEMP buttons at the same time for three seconds.

FATC Control Panel Functions

Temperature Unit Display

The user can switch between metric and standard temperature display units by holding the AMB button down and pressing the TEMP down button for three seconds. The default display (at battery re-connect) is in metric units.

TEMP Switch

The TEMP switch allows temperature settings to be raised or lowered. The range is 62° to 90°F in one degree increments.

AUTO Switch

The AUTO switch is used to place the system in automatic mode. The FATC system will automatically adjust blower speed, mode door position, intake air mode, temperature, and A/C compressor operation based on the desired temperature selected by the user.

DEFROST Switch

Pressing the DEFROST switch results in the mode door transitioning to defrost mode. In addition, the A/C compressor will be activated (if conditions permit) and the intake actuator will switch to fresh air mode. Blower speed and temperature must be selected manually in this mode.

A/C Switch

The A/C switch permits manual ON/OFF selection of the A/C compressor.

OFF Switch

Selecting the OFF switch shuts the blower down and deactivates the A/C compressor clutch. The temperature door will revert to automatic control. The mode door will be in AUTO or manual mode depending on the state of system operation at the time the OFF switch was pressed. In addition, the intake door will switch to the fresh air position.

MODE Switch

By pressing the MODE switch, the user can cycle through VENT, B/L, FLOOR, and MIX positions. Blower speed and discharge temperature are manually controlled.

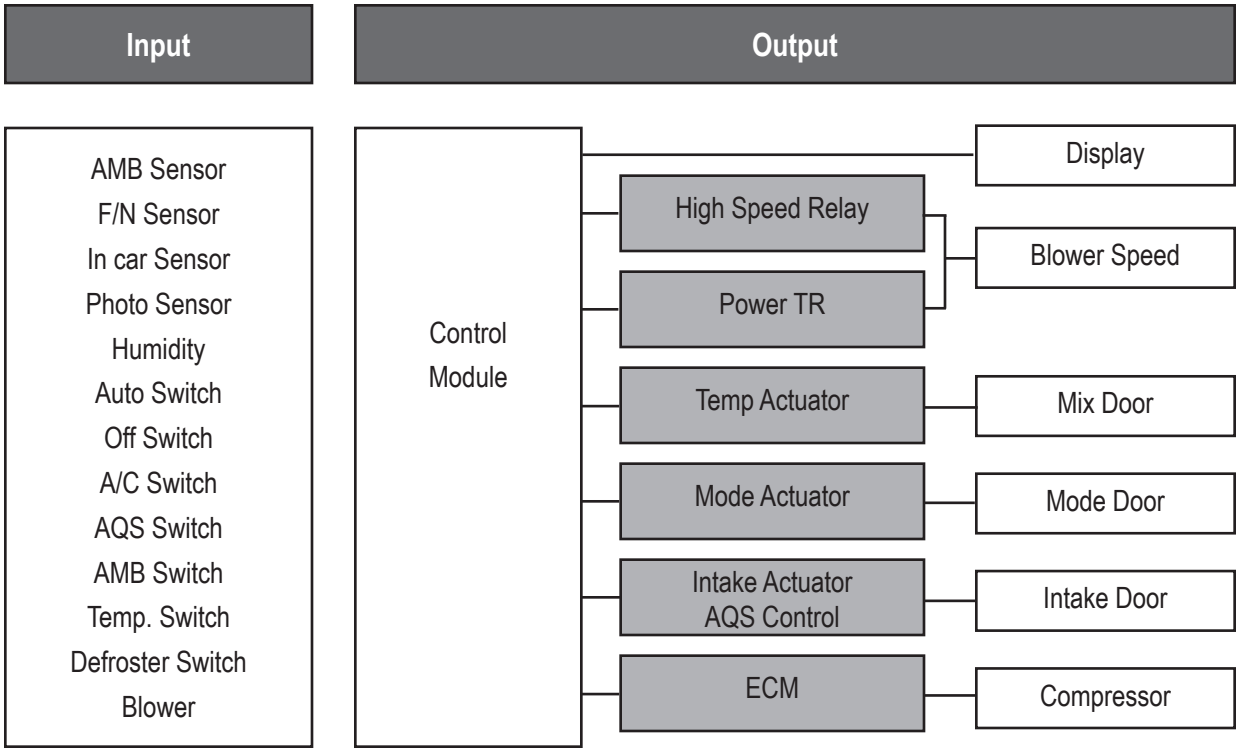
RECIRC Switch/FRESH Switch

The RECIRC and FRESH switches permit selection of the intake air source.

AMB Switch

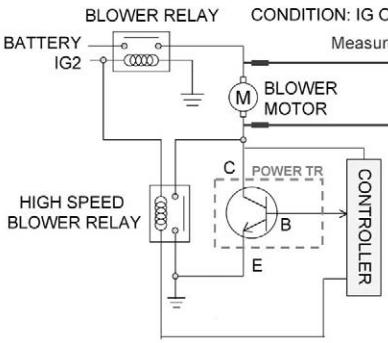
Ambient outdoor temperature is displayed for five seconds after the AMB switched is pressed.

FATC Input and Output



Power Transistor

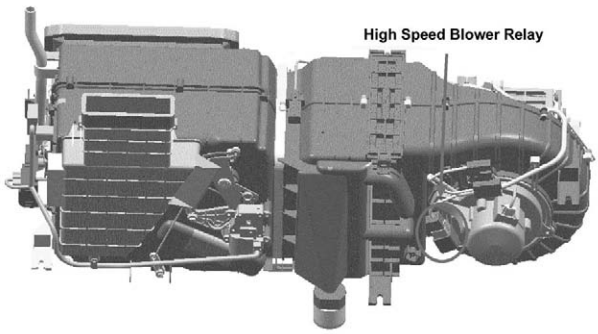
The blower motor has six possible speed variations. Instead of a conventional resistor assembly, a power transistor is used for speeds one through five. The power transistor is located in the heater case assembly.



BLOWER SPEED	VOLTAGE(V)
1	4.0 ± 0.5
2	5.6 ± 0.5
3	7.3 ± 0.5
4	9.0 ± 0.5
5	10.5 ± 0.5
6	B+

High Speed Blower Relay

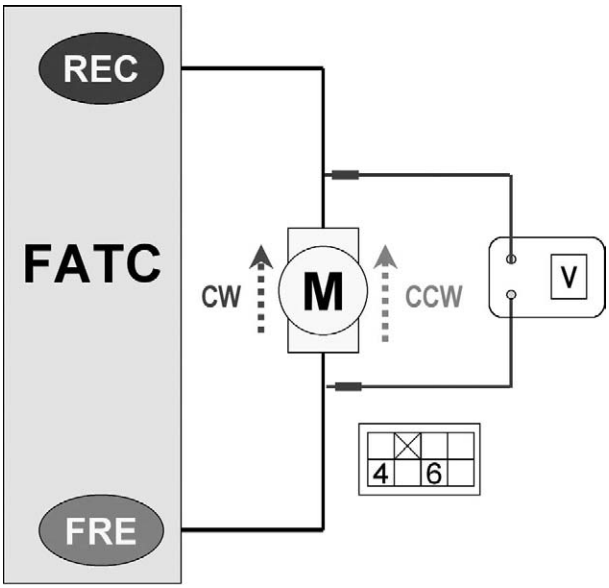
For high speed operation, battery voltage is applied directly to the blower motor via a relay located next to the blower motor.



Intake Door Actuator

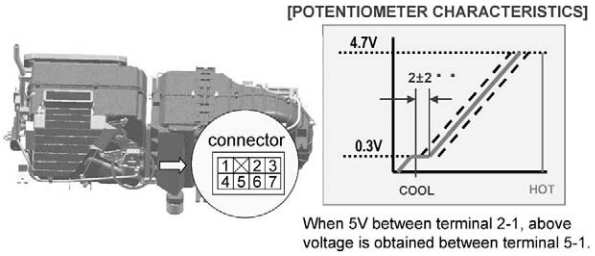
A 12-volt motor is controlled using a reverse-polarity circuit to select the source of intake air.

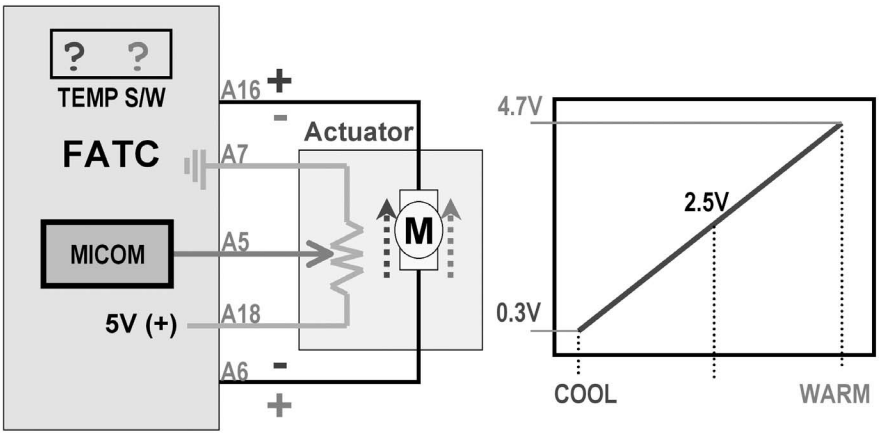
Mode	Terminal #4	Terminal #6
FRE	-	+
REC	+	-



Temp Door Actuator

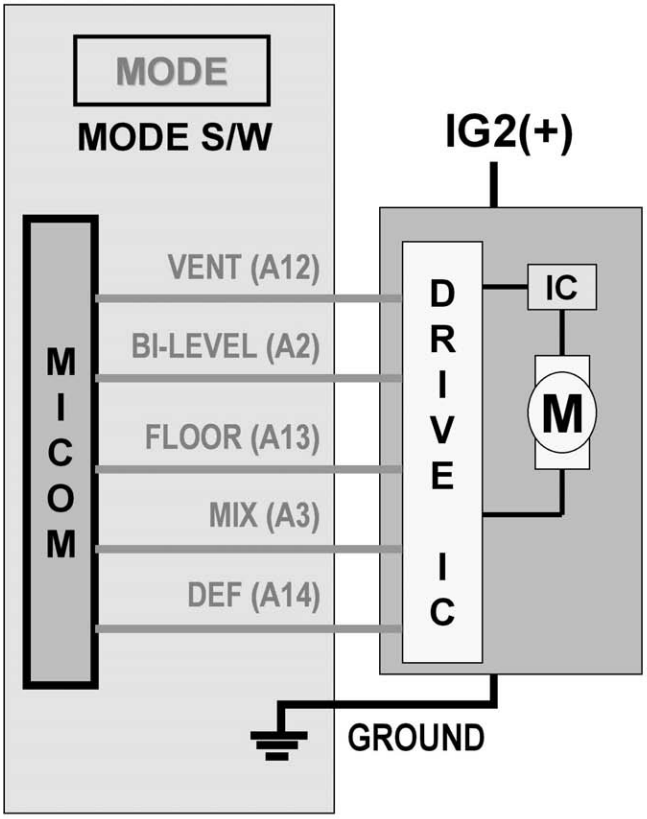
Located in the bottom of the heater case, the **Temp Door Actuator** controls the position of the temperature blend door. A potentiometer within the actuator assembly detects door position and provides a feedback signal to the FATC control unit.

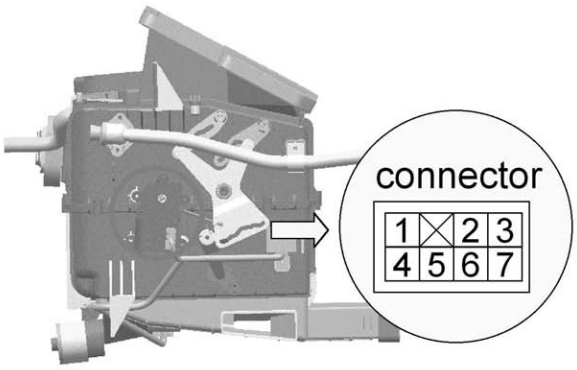




Mode Door Actuator

The **Mode Door Actuator** controls direction of airflow based on signals from the FATC control unit.





MODE	5	4	3	2	1
VENT	G	+	+	+	+
Bi-LEV	+	G	+	+	+
FLOOR	+	+	G	+	+
MIX	+	+	+	G	+
DEF	+	+	+	+	G

*** G: Ground**

Inspection

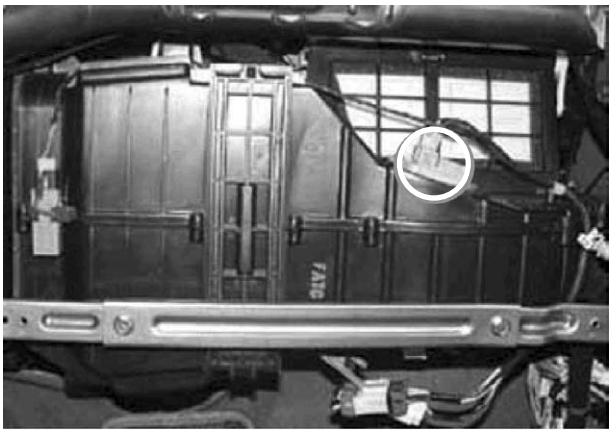
- Apply 12V to mode actuator terminal 7 and ground terminal 6.
- Verify that the mode actuator operates as below when grounding terminals 5,4,3,2 and 1 in sequence.

  Vent→Bi-Level→Floor→Mix→Def

FATC System Sensors

Fin Thermo Sensor

The **Fin Sensor** is a negative temperature coefficient thermistor installed on the evaporator core. It is monitored by the FATC control circuitry to prevent evaporator freezing. The A/C compressor will shut down if evaporator temperature drops below 33°F. Compressor re-activation will resume between 38.3-39.2°F.



Characteristics

Temp. °F	Resistance (kΩ)	Temp. °F	Resistance (kΩ)	Temp. °F	Resistance (kΩ)
14	18.01	47	8.02	79	3.87
17	16.39	50	7.36	83	3.59
21	14.93	54	6.77	86	3.33
24	13.61	58	6.24	90	3.09
28	12.43	61	5.75	93	2.87
32	11.36	65	5.3	97	2.67
36	10.39	68	4.89	101	2.48
40	9.52	72	4.52	104	2.31

FATC System Sensors

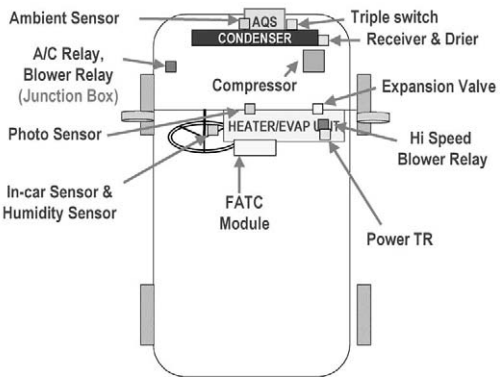
In-Car Sensor

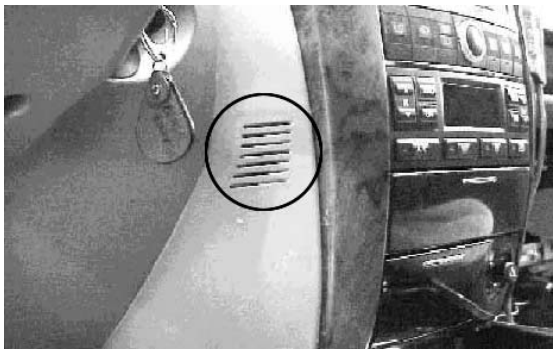
The **In-Car Sensor** is located in the lower center console to the left of the FATC panel. This Negative Temperature Coefficient thermistor communicates vehicle interior temperature information to the FATC control unit.

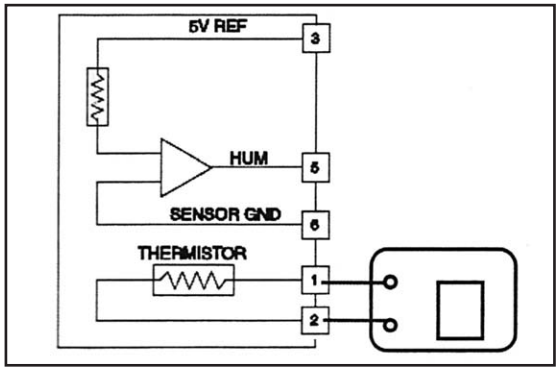
In-Car Sensor Characteristics

Temp (°F)	Resistance
64	3.4
70	2.98
77	2.5
83	2.2
90	1.86

**** Resistance checks are between terminals 1 and 2***





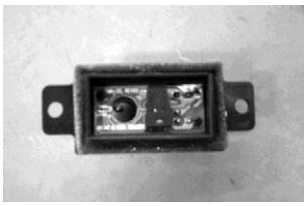


(top) In-Car Sensor, and (bottom) schematic of In-Car Sensor

Humidity Sensor

The **Humidity Sensor** is part of the In-Car Sensor assembly. The FATC control unit analyzes humidity to determine the need for A/C compressor operation which will reduce fogged windows.

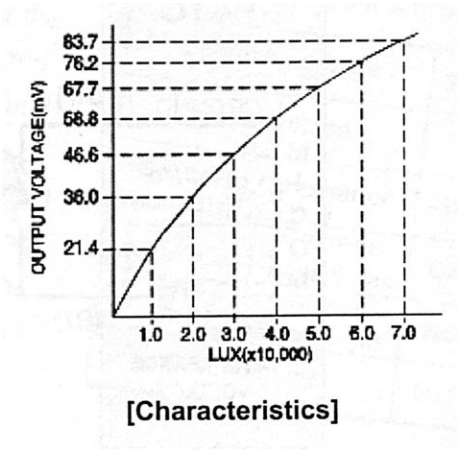
(right) Humidity Sensor (below right) Humidity Sensor schematic



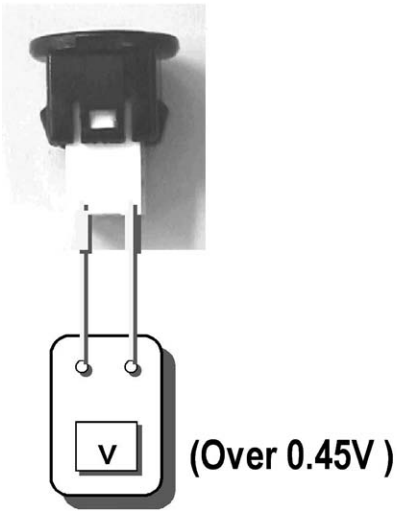
FATC System Sensors

Photo Sensor

The **Photo Sensor**, located near the driver side defrost duct, uses a photovoltaic diode to transmit light level information to the FATC control unit. This compensates for changes in solar radiation by adjusting the blower speed and discharge temperature.



[Characteristics]



(left) Photo Sensor characteristics

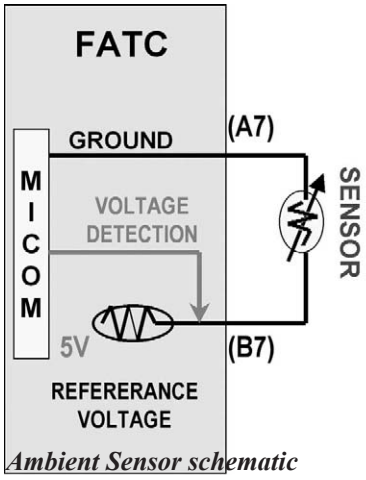
(right) Photo Sensor operation

Ambient Sensor

The **Ambient Sensor** is located forward of the condenser fan shroud. The Negative Co-Efficient characteristics of this sensor are utilized by the FATC control unit to detect ambient outdoor temperature; these values are then taken into consideration during AUTO mode operation.

Resistance Between B7 & A7

Temp (°F)	Resistance
-4	24.4
14	13.8
32	8.1
50	4.9
68	3.1
86	2
104	1.4



Ambient Sensor schematic

FATC Self-Diagnosis Procedure

Self-diagnostics and fail-safe functionality are designed into the FATC system. Diagnostic Trouble Codes are retrieved using the switches on the FATC control panel.

DTC Retrieval

1 Turn the ignition switch to the ON position.

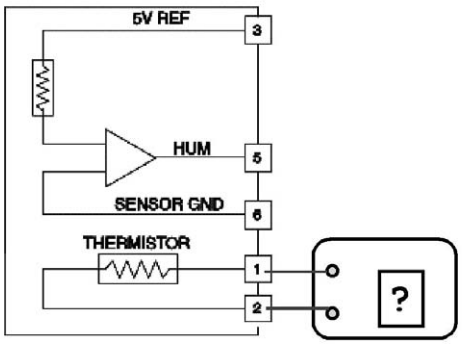
2 Set the temperature to 77 Degrees Fahrenheit (25 degrees Celsius)

3 Hold the A/C switch down, and press the Mode switch more than three times within five seconds. All graphic segments will blink two times at the rate of four cycles per second. The letters "HHCC" will then appear and blink at the same rate. At that point, self-diagnostics will initiate. After all DTCs are displayed, the codes will be displayed two additional times before the FATC unit exits the self-diagnostic routine.

DTC Code	Description	Fail Safe
E0	Normal	—
E1	In-Car Sensor Fail	77°F Fixed
E2	Ambient Sensor Fail	77°F Fixed
E3	Fin Sensor Fail	28°F Fixed
E5	Photo Sensor Fail	—
E6	Temp Door Potentiometer Fail	Setting Temp. 63~77°F: Max Cool Setting Temp. 77~90°F: Max Hot

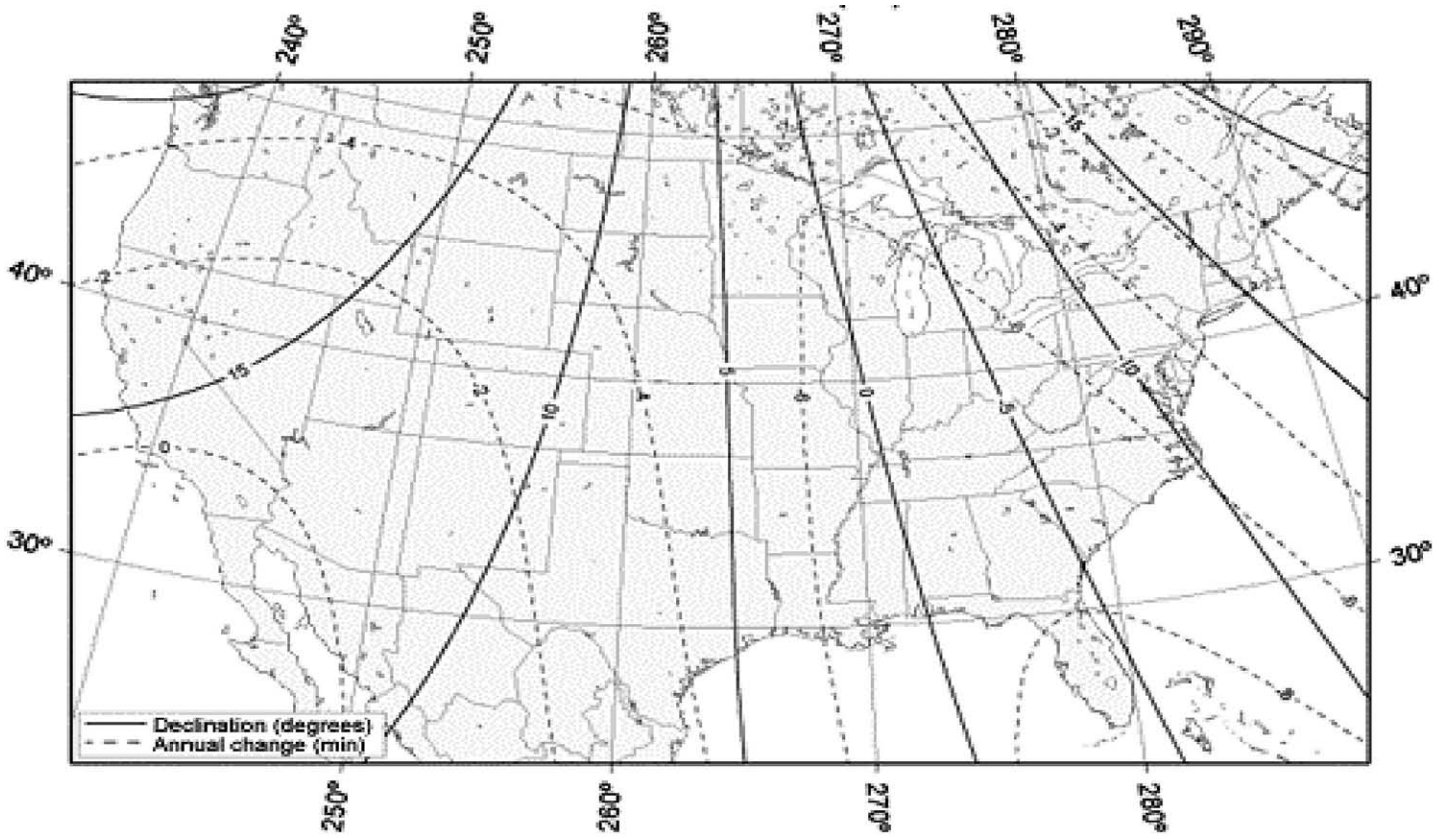
Multimeter

The **Multimeter** on the 2003 Sorento is similar in exterior appearance to the Trip Computer on the 2002 Sedona. Functionality, however, is significantly different between the two units. The Multimeter on the 2003 Sorento is fitted with compass, altitude, barometric pressure, and temperature modes. Using the Mode switch, the user can cycle through the available functions. The temperature feature will not be included on vehicles equipped with the Fully Automatic Temperature Control System.



Compass

The **compass** function provides bearing (direction of travel) information to the user. It is known that a magnetic compass does not point to true (geographic) North. *Magnetic North* is the direction in which a compass will point. Over most of the surface of the Earth, this means that a compass will point at an angle east or west of true north. To compensate for this, *Magnetic Declination* must be taken into consideration. Magnetic Declination is the angle between magnetic north and true north.



Declination Correction

1 Turn the ignition key ON and access the compass function. "DRT" will be shown in the display.

2 Press and hold the MODE/SET switch for 4 seconds. The display will change from a direction to a number followed by an "E" or "W".

3 Select the degree of correction from the map above. (example: Chicago, Illinois would be 0 degrees)

4 Press the UP or Down key on the Multimeter panel until the appropriate correction is indicated in the display.

5 Press and hold the MODE/SET key until the display changes back to its normal view.

Position Correction

Position correction should be performed if the displayed bearing differs from the actual bearing of the vehicle, or if the battery has been disconnected.

1 Start the vehicle, access the compass function and hold the MODE/SET key until the "DRT" indicator flashes.

2 Turn the vehicle slowly 360 degrees or more within 128 seconds. Bearing correction is automatically performed; the "DRT" indicator will cease flashing when completed. This should be done at speeds of 12.5MPH or less. *Completion of this procedure may require more than one complete 360 degree turn.*

Note: the "DRT" indicator will flash during normal driving if abnormal data is detected for a duration of 5 minutes.

Relative Altimeter

The **Relative Altimeter** displays the difference in altitude traveled. For example, if a customer lives in Denver, Colorado, at elevation 5,280' and sets the relative altimeter to zero before leaving on a trip to Pike's Peak at elevation 14,100'. When the customer arrives at Pike's Peak, the difference in elevation (8,830') will be displayed on the relative altimeter.

The range is +/- 9800 feet. To reset the altitude reading to the current altitude, press and hold the MODE/SET switch for one second or more, which will set the relative altimeter to zero. Pressing the UP or DOWN switch for one second will allow the units to be changed from metric to standard and vice versa. The altimeter data is derived from a barometric pressure sensor which may affect altitude readings (at the same location) depending on pressure variance.

Note: The altimeter will retain its value at key OFF.

Barometer

The **Barometer** displays atmospheric pressure in Hectopascals. 1013 hPa is equivalent to 29.92 inches of mercury, or 14.7 psi (air pressure at sea level).

Note: The sensor used for the Altimeter and Barometer functions is self-contained within the Multimeter.

Outside Temperature

Ambient outside temperature is displayed in Celsius or Fahrenheit units; pressing the UP or DOWN keys for one second or more changes the display units.

Section 10 • Supplemental Restraint System

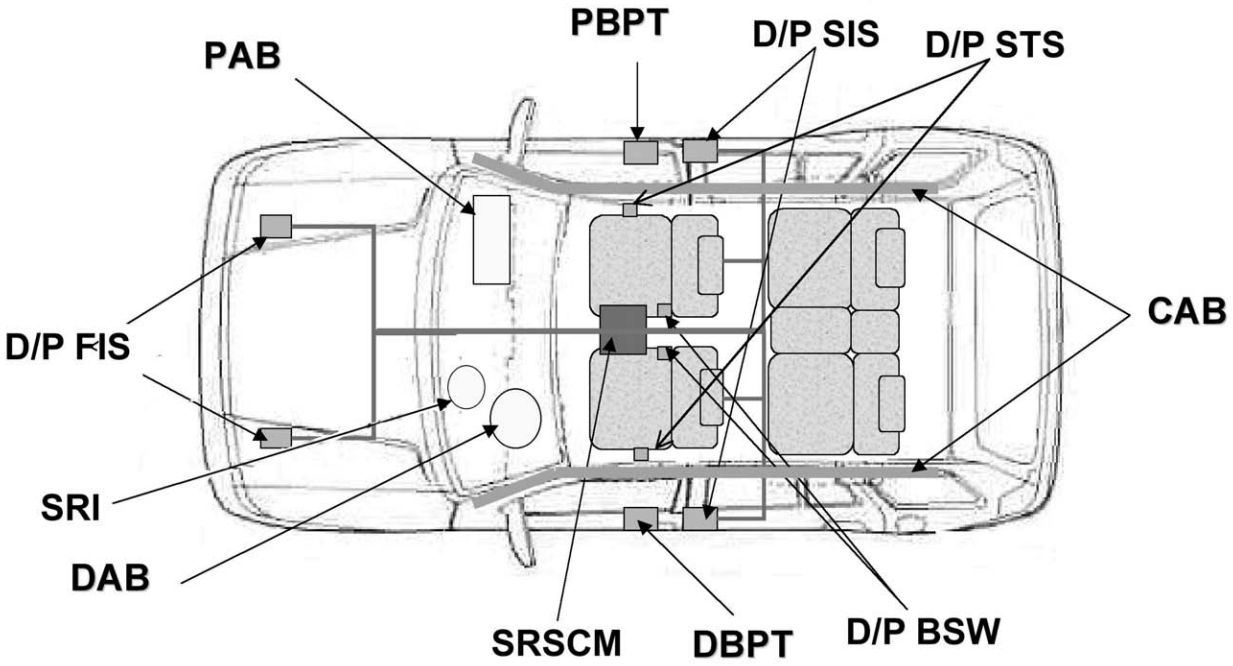
General Information

Please consult the Service Manual for recommended service procedures.

The 2003 Sorento is equipped with the new Siemens Smart Air Bag System. This new Smart System features the ability to control the deployment speed of the driver and passenger's front air bags with the use of dual-squib air bag modules. Other features of this system are the side impact curtain airbags and front seat belt pretensioners. The air bag systems are designed to supplement the seat belts to help reduce the risk and severity of injury to the driver and passengers in the event of a collision.

The major components of this system are:

- Supplemental Restraint System Control Module (SRSCM)
- Driver Airbag Module (DAB)
- Passenger Airbag Module (PAB)
- Left and Right Side Curtain Airbag Module (CAB)
- Seat Belt Pretensioners—Driver (DBPT) and Passenger (PBPT)
- Seat Track Sensors—Driver (DSTS) and Passenger (PSTS)
- Front Impact Sensors—Driver (DFIS) and Passenger (PFIS)
- Side Impact Sensors—Driver (DSIS) and Passenger (PSIS)
- Buckle Switches—Driver (DBSW) and Passenger (PBSW)
- Wiring Harness and Clock Spring
- SRS Service Reminder Indicator (SRI)

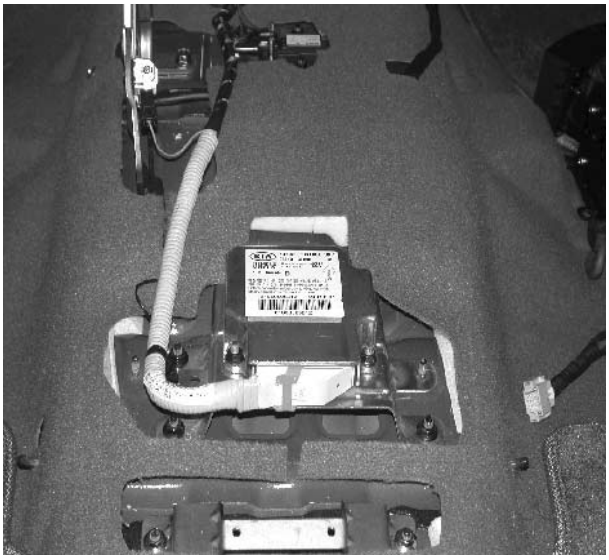


SRS Control Module

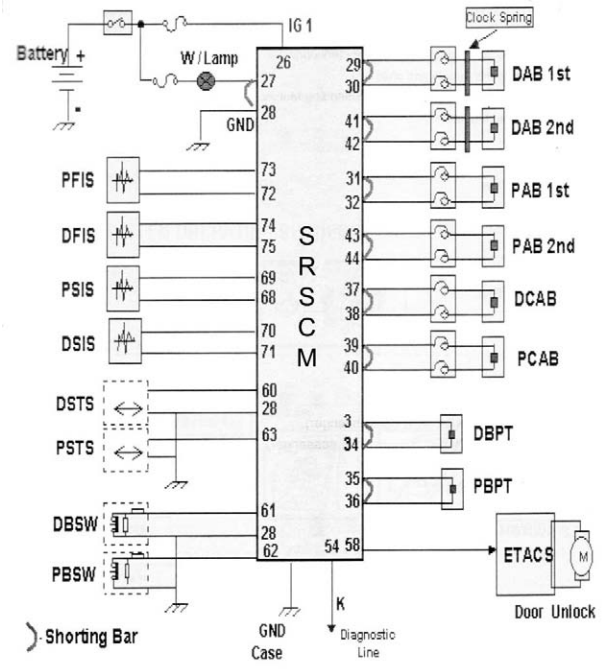
The **SRS Control Module** (SRSCM) is located on the floor behind the shift lever and hand brake. Access the SRSCM connector by removing the rear panel of the center console. The primary functions of the SRSCM are crash detection, airbag and pretensioner activation, and monitoring the airbag and pretensioner systems. The SRSCM determines when to deploy the airbag modules by sensing frontal and side impact forces. The SRSCM also monitors the front seat belt buckle switches and seat track position sensors, controls operation of the SRI, stores Diagnostic Trouble Codes in non-volatile memory, and stores information regarding component deployment (crash information).

The SRSCM has emergency energy reserves to provide deployment energy for a short period if vehicle voltage is low or lost in a crash. The SRSCM also provides a signal after a deployable crash to unlock the vehicle doors. The SRSCM must be replaced if any of the airbags deploy. However, the SRSCM may be reused if only the pretensioner has deployed. After six pretensioner deployments, an internal fault code is generated in the SRSCM and the SRSCM must be replaced.

Warning: *The battery must be disconnected for 10 minutes prior to disconnecting the SRSCM connector or performing any repair/testing procedure on the SRSCM systems. (Note: These capacitors hold a charge for a period of time after the battery has been disconnected. Please consult the Service Manual for proper procedures.)* Failure to do so may result in severe injury. In addition, the SRSCM must be installed with the correct orientation to ensure that the sensors are positioned along the longitudinal centerline of the vehicle. The bolts should be torqued according to sequence. Refer to the Service Manual for correct specifications and additional information.



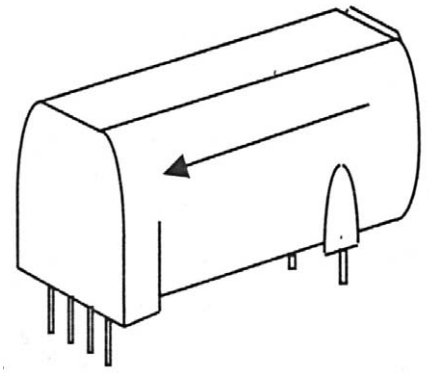
Note: These capacitors hold a charge for a period of time after the battery has been disconnected. Disconnect the battery for 10 minutes before performing any service on the SRS system. Please consult the Service Manual for proper procedures.



Safing Sensor

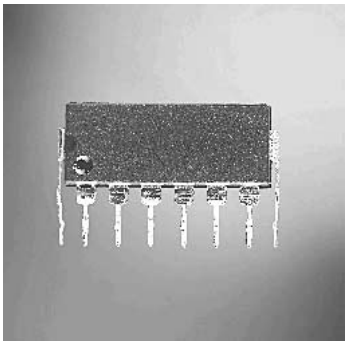
All firing current for airbag deployment must go through the **Safing Sensor**. The safing sensor is a dual contact electromechanical switch, which closes if the vehicle deceleration exceeds a specified threshold.

The operation of the sensor is completely independent of all electronic components in the SRSCM and ***the firing current must flow across the safing sensor contact to activate the airbag modules and/or seatbelt pretensioners***. This provides protection against an unwanted deployment of the airbag or seatbelt pretenionser firing circuits.



Accelero-meter

The SRSCM integrated electronic **Accelerometer** provides an electrical representation of the acceleration experienced by the vehicle in the longitudinal direction. This electrical signal is linearly proportional to the vehicle acceleration in Gs and is used to determine the severity of the collision.



Driver Airbag Module

The **Driver Airbag Module** (DAB) is mounted on the steering wheel and is connected to the wiring harness through the clock spring assembly; this ensures a consistent connection without regard to steering wheel position. The DAB is 60 liters in size when fully inflated. The DAB uses a module that has a dual squib inflator designed to deploy in stages depending on the severity and velocity of the collision. The dual squib inflator design is used to tune the deployment characteristics of the driver airbag system into three stages.

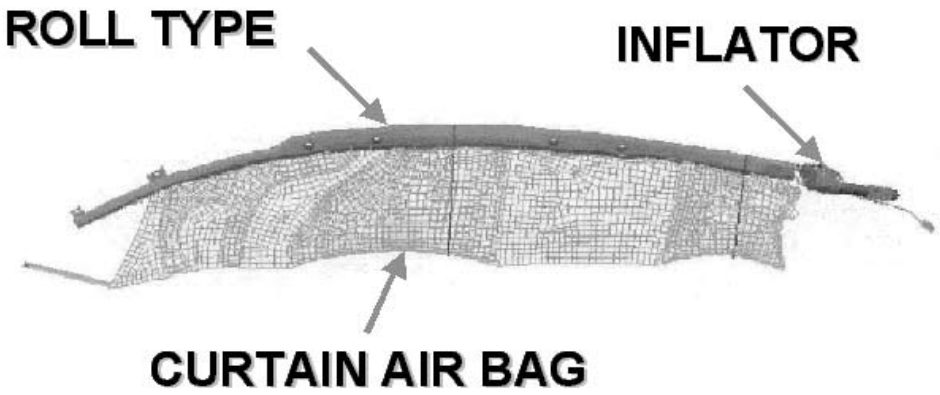
- Stage 1—one squib fires
- Stage 2—second squib will fire after the first squib
- Stage 3—squib one and two fire simultaneously

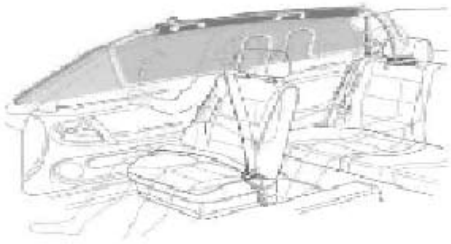
Passenger Airbag Module

The **Passenger Airbag Module** (PAB) is installed as part of the instrument panel assembly. The PAB features an invisible U-pattern tear seam. Deployment of the PAB will require replacement of the instrument panel. Once the PAB is fully inflated, there are no vent holes to deflate the airbag. The PAB module also uses a dual squib inflator and deploys in stages like the DAB.

Curtain Airbag Module

The side curtain airbags drop down from the headliner and can inflate on either sides of the vehicle. The curtain airbags operate independently of the DAB and PAB based on inputs to the SRSCM from the side impact sensors.



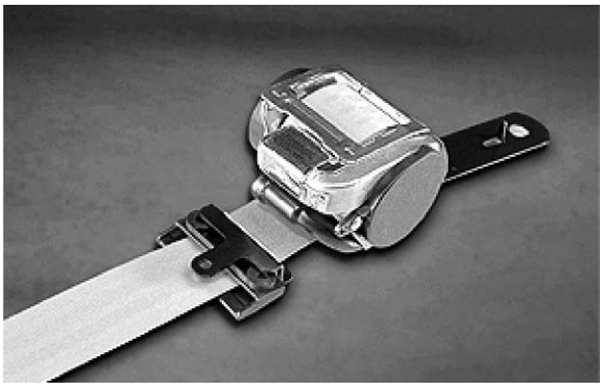


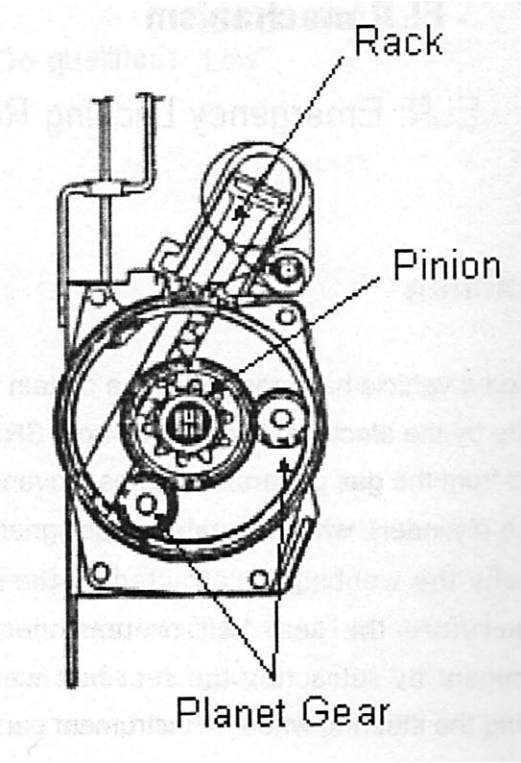
Seat Belt Pretensioner

The front **Seat Belt Pretensioners** are incorporated within the seat belt retractor and help to reduce the severity of injury during a collision. When the seat belt pretensioner is activated, it spools in the seat belt webbing, tightening the seat belt, and helps keep the occupant in position. After the seat belt is tightened, it then releases slightly during the collision through the use of the built-in force limiter that provides the occupant with a controlled ride into the frontal airbags. Only the front seats on 2003 Sorento have seat belt pretensioners.

During a collision, the SRSCM will control the activation of the seatbelt pretensioners based on the severity of the collision. The SRSCM sends an electrical firing signal to the pretensioner squibs in the gas generator mounted on the seatbelt assembly. The gas generator produces a force that moves the piston forward. The piston shaft is a rack that engages with a gear set that drives a pinion gear. The pinion gear then turns the spool to retract the webbing, tightening the seat belt for the occupant.

Caution: A pretensioner functions one time only. Be sure to replace the seat belt pretensioner with a new one after activation. The SRSCM need not be replaced unless six pretensioners have been activated.



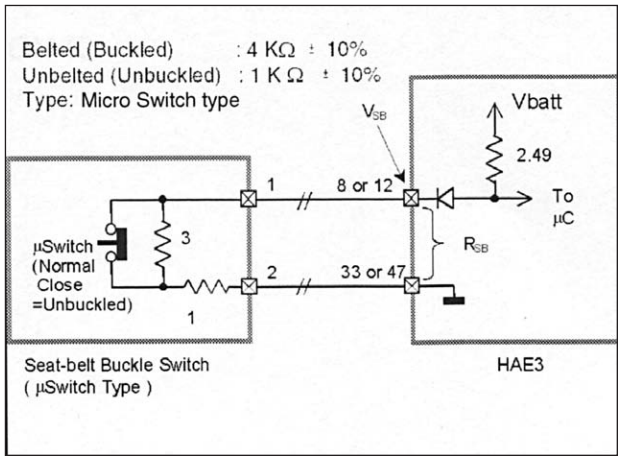


Seatbelt Force Limiter

The front seatbelt **Force Limiter** is designed to reduce the restraining force of the seatbelt webbing the occupant's chest experiences during a collision. If the collision force reaches a certain value, the torsion bar in the pretensioning seatbelt system deforms and allows a small webbing to be extracted from the seat belt thus reducing the restraining force on the occupant.

Seat Belt Buckle Switch

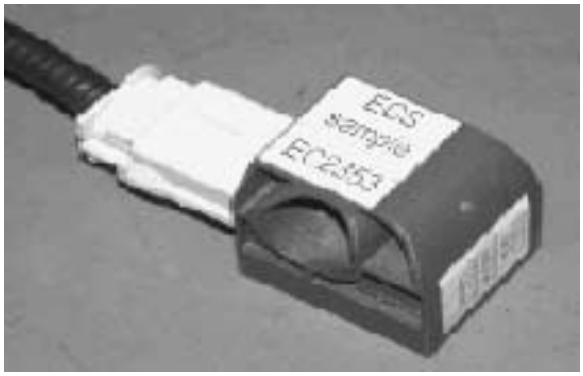
The SRSCM monitors the buckle switches for the front seats to determine the threshold for activation of the air bags and occupants' seatbelt pretensioners. During a low threshold collision, the seatbelt pretensioners only may be activated, provided that the seatbelts are buckled. However, if the seatbelts are not buckled, then the air bags are deployed.



Front Impact Sensor

The 2003 Sorento uses two **Front Impact Sensors** to aid the SRSCM in determining impact severity. These sensors are mounted to the frame rails behind the front bumper. Depending on the velocity and severity of the collision, the SRSCM will determine the deployment characteristics of the airbags and seatbelt pretensioners.

- Stage 1—one squib fires
- Stage 2—second squib fires within 100 milliseconds of first squib
- Stage 3—squib one and two fire simultaneously

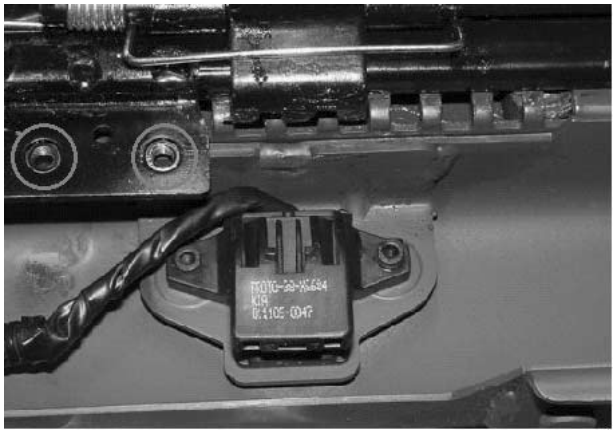


Side Impact Sensor

The **Side Impact Sensors** provide the SRSCM with input signals required to determine the severity of impacts from the sides. Based on these signals the SRSCM may deploy either the left or right side curtain air bags. These sensors are mounted at the base of each "B" pillar.

Seat Track Sensor

The 2003 Sorento uses **Seat Track Sensors** to determine the distance that each front seat is away from the air bag. If the seat track sensor detects that the seat is close to the air bag module, the SRSCM will cause the air bag to deploy with squib 1 and 2 firing simultaneously to reduce the risk of injury to the occupant.



Service Reminder Indicator (SRI)

When the ignition is turned on and operating voltage is applied to the SRSCM, a bulb check will be done for the **Service Reminder Indicator (SRI)**. During this initialization phase the lamp will blink six times in six seconds and then be turned off. During the initialization phase, the SRSCM will not be ready to detect a collision. Deployment will be inhibited until the signals in the SRSCM circuitry finish initialization. The SRI will illuminate continuously if there is a loss of ignition voltage supply to the SRSCM or a loss of internal operating voltage. The SRI will also remain illuminated continuously through the shorting bar in the wiring harness connector if the SRSCM is disconnected. The SRI will flash at approximately 1Hz should there be a loss of SRSCM operation.

	Operating situation	Operating method
RUNNING	Return to normal from temporary fault	ON → OFF
	ΣFaults frequency ≥ 5 Active fault	Turn it on continuously
STARTING	Normal	Blink 6 times
	Σ Faults frequency ≤ 5	On to off after 6 seconds
	ΣFaults frequency ≥ 6 Active fault	Turn it on continuously

SRS Diagnosis

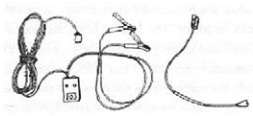
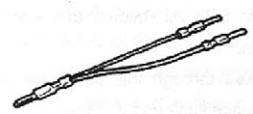
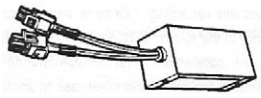
Diagnostic Trouble Codes for the 2003 Sorento supplemental restraint system are displayed as B codes which must be retrieved using the Hi-Scan Pro.

- Connect the Hi-Scan Pro to the vehicle's underhood DLC.
- Turn the ignition key to the "ON" position and turn on the Hi-Scan Pro.
- Access Kia Vehicle Diagnosis for SRS.
- If a system fault is detected there is a possibility that the fault is not in the component but in SRS wiring or connector.

Caution: Do not repair SRS components or wiring. Replace defective parts.

Note: *Please consult the Service Manual before servicing the supplemental restraint system.*

Special Service Tools

Deployment tool (095A-34100-A) • Deployment of undeployed airbag module • SRSCM Deployment Adapter Harness DAB: 0957A-38100 PAG: 0957A-34200	
Diagnosis check wire 0957A-38000	
Dummy 0957A-38200 Dummy adapter DAB, SAB: 0957A-38300 PAB, BPT: 0957A-38400	
Dummy adapter 0957A-38300 Adapter to connect PAB	
Dummy adapter 0957A-38400 Adapter to connect BPT	
Dummy adapter 0957A-38100 (Use with 0957A-34100A)	

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